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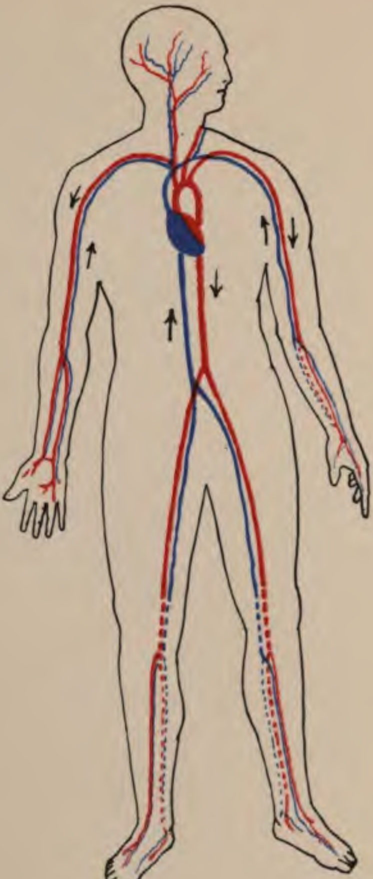

ARTERIES—RED.
VEINS—BLUE.

The Maintenance of Health in the Tropics

BY

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PREFACE.

This handbook on the Maintenance of Health in the Tropics is written at the request of the Committee of the London School of Tropical Medicine, and is published under their auspices. It is felt that a small manual dealing with Personal Hygiene in a simple and popular manner is much needed, and would be very useful to those residing in or visiting the Tropics.

W. J. SIMPSON.

King's College,
March, 1905.

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THE MAINTENANCE OF HEALTH IN THE TROPICS.

CHAPTER I.

CLIMATE AND PERSONAL PRECAUTIONS.

IT will perhaps be well to begin this handbook by stating what are the regions to which the terms tropical and subtropical apply. The tropical or torrid zone is that part of the earths' surface which extends from the equator to the north and south parallels of 23° 28′ 40″. The tropic of Cancer is its northern parallel; the tropic of Capricorn is its southern. Between these parallels is the apparent path of the sun, and over some portion of the belt the sun is always vertical. The subtropical zone is a region extending beyond the Zodiac belt to 35° north and south, and comes under the powerful influence of the sun on its approach to the tropic of Cancer or the tropic of Capricorn.

The climate of this vast region, embracing some 70° of the earth's surface, varies greatly.

Climate.

The torrid zone, as its name implies, has the highest mean temperature, but there is great variation in temperature even within this zone. This variation depends on a number of conditions which it is needless to enter into here. But it may be stated generally that the climate and temperature in the tropical and subtropical regions are governed largely by the amount of humidity in the air and the amount of rain the locality receives and the situation of the locality, whether it is in the plains near the sea or inland on the high lands. Islands and coast regions possess a more equable temperature than the interior of continents. The abundance of rain and amount of watery vapour in the air in the equatorial regions prevent the temperature reaching those extremes which are to be found farther away from the equator and in drier regions. The temperature in these equable regions is seldom above 85° or 90° in the shade, but in the drier regions it may be as high as 120° in the summer. The climate may be broadly judged of by the kind and nature of the vegetation. The influence of a powerful sun, permanent warmth, great moisture, and equable seasons is displayed in an endless variety of luxuriant vegetation not to be seen in any part of Europe ; on the other hand, the influence of a powerful sun, parching winds and a small amount of rain is distinctly unfavourable to vegetation, and large tracts of the country may remain arid and uncultivated. There are many gradations between these two extremes which indicate more or less approximation to moist or dry climates.

A European requires to exercise reasonable care for his health in the Tropics.

A European entering the tropics has to be careful in many things, if he is to preserve his health. The environment is so different from that which he has been accustomed to that it requires a certain time before he becomes acclimatised to the new conditions.

Full of the energy begotten of a birth-place in a temperate or cold climate, he is not sensible at first of the great power of the sun, and of the great difference of temperature of the air to which he is subjected. He is accordingly apt to expose himself in a way that with more experience he would never dream of, and to forget to adapt his mode of life to the new conditions. There are rules or axioms which should never be forgotten in the tropics. The first is not to expose oneself to the sun unless the head is well protected; the second is to avoid chills, which may easily be contracted by exposing the body to the cool evening breezes when fatigued or over-heated by exercise, and the third is to avoid as far as possible the infection of malaria.

If attention is paid to these three rules, life in the tropics, even under the most trying conditions, may be as healthy as in temperate regions, always provided that, as at home, the ordinary sanitary canons as regards purity of water and drink, wholesome food, healthy dwellings and personal hygiene are attended to.

Precautions against undue exposure to the sun's rays.

There should be no undue exposure to the sun's rays, especially during the hottest hours of the day, unless well protected. It is true that some constitutions appear to be able to withstand any amount of exposure to the sun, just as others are often able apparently to withstand the injurious effect of excessive drinking. Such individuals will go about during the day with an ordinary cap on their head, or even bare-headed. They are exceptions, and their example should on no account be followed. Excessive exposure to the sun, and especially so when the atmosphere is full of moisture, almost invariably produces headache, slight fever, and ultimately a high degree of nervous irritability ending not infrequently in a nervous breakdown. Sometimes it causes sunstroke.

As there is great variation in the heat in the tropics, the following remarks will apply to the hottest regions and to those parts in which the sun and atmospheric conditions are dangerous. The precautions may be modified to suit the circumstances of those localities that enjoy a lower temperature. If duty involves much exposure to the sun in the summer time it is necessary for the head and spine to be thoroughly protected. In India the head is protected by wearing a solah topee, which is made of pith.

It is light—which is always an important point in any headgear in hot climates. It should be shaped to shield the temples and the nape of the neck, and it should be so ventilated as to permit of a good circulation of fresh air in the space between the head and the topee. Helmets and topees are often made of felt; these are neater looking, but they are usually possessed of very little protective power, and should be avoided. Large "Terai" hats, generally with a puggree on them to protect the back of the neck, are preferred in some localities. In places where the glare is great the eyes need protection by wearing neutral tinted or dark smoke-coloured glasses. The latter are generally the more comfortable. As the spine is sensitive to the sun's rays, a spinal pad fixed in the lining of the coat is an additional protection, especially when out riding or shooting, or on the march. The injurious effects of the sun are believed to be caused by the chemical rays rather than by the heat rays. For this reason it is recommended that red, orange or yellow-coloured materials, which do not allow the chemical rays to pass through them, should be used for the lining of the topee and of the spine pad. For the same reason a shirt or vest of one or other of these colours may be worn. Natives of hot climates are fond of these bright colours, and it is possible that they have learnt from experience their comfort. Woollen socks should be worn, and when out in the jungle or camping out strong boots with puttees or leggings should also be worn. The latter are protective against snakes, leeches, and insects. If compelled to go out during the hottest part of the day in the summer, it is better not to walk; but if this cannot be avoided it is well to be provided with a good large white umbrella, a pair of smoke-coloured spectacles, and a broad-brimmed topee. If in a conveyance the hood should always be up. In long journeys the hood is often protected by wetted straw or matting. If in a railway train crossing the plains of India in April and May the tatties need to be constantly kept wet, and much relief is afforded by bathing the head when feeling uncomfortable, and by occasionally sipping ice water.

Heat stroke and heat exhaustion and their treatment.

Persons suffering from exhaustion or ill-health should not travel during the extremely hot season, for at this time though there may be no direct exposure to the sun, the high temperature in the shade—especially if the air is stagnant and impure—may produce sunstroke or heat-stroke, or heat-exhaustion. Sunstroke or heat-stroke in its milder forms is characterised by giddiness and faintness, headache, fever, intolerance of light, and vomiting. Its graver forms have more pronounced symptoms, in which the head is much congested, the breathing is difficult, the temperature is high, and the patient becomes unconscious. Treatment should be immediate, and until the doctor arrives the sufferer should be taken to a cool, shady place, the clothes should be loosened, and ice and cold water should be applied freely to the head and back of the neck. On the other hand, in heat exhaustion the patient becomes pale and giddy, falls to the ground, and is almost pulseless and very cold. The patient has fainted. The treatment is the same as for an ordinary fainting fit. Lay the patient on his or her back in a cool and airy place, loosen the clothes, apply ammonia or smelling-salts to the nostrils, and dash a little water on the face and neck.

Exercise essential to health in the tropics.

On the other hand, while a warning is necessary to the new arrival against undue exposure to the sun, an equal warning is required not to lead a too sedentary life and remain too much indoors. Exercise and an open air life are essential to health in the tropics, and can readily be obtained all the year round, except during the hottest hours of the day. The period of prohibitive heat during the day varies much in different places, being longer in some places than in others. It also varies according to the season of the year. Exercise should be regular and short of fatigue. The people who enjoy the best health are generally those who are fond of riding and outdoor exercise, such as lawn tennis, rackets, golf, bicycling, and other similar pastimes. Walking is also a good form of exercise. Care has to be taken that the exercise shall not be carried to excess. Over-fatigue is apt to bring on languor and fever, which neutralise the benefits derived from exercise.

Precautions against chills.

Precautions against chill are particularly necessary on account of the sensitive state of the skin, which is peculiarly susceptible to external impressions of cold. Chill holds a very important place as the exciting cause of disease in warm climates. The skin is more active and sensitive in a hot climate than in a cold. There is a larger supply of blood at the surface, and the evaporation and perspiration from the body are greater. A sudden check to the transudation from the skin, or to the perspiration, is apt to cause disturbances of the liver, bowels, or other internal organs. It is, therefore, advisable as far as possible to prevent the skin from being subjected to great changes of temperature. This is best effected by not exposing the body when overheated to sudden cold, and by wearing suitable garments next to the skin which will keep the body at an uniform temperature.

Violent exercise, followed by a drive in the evening before changing the clothes, may be the cause of a severe attack of diarrhœa, inflammatory dysentery or congestion of the liver. After lawn tennis or golf, a thick overcoat,

To be careful not to expose the body when over-heated or fatigued to sudden cold.

sweater or cloak should be immediately put on, and the clothes should be changed as soon as possible. The sitting in a draught, or under a punkah, or opening one's jacket to enjoy the coolness of the evening breeze whilst in a state of perspiration or exhaustion is to be avoided. It is a precaution which is at first not easy to remember, but the enjoyment, though ever so pleasant, is fraught with risks. When heated or fatigued, a cold bath ought never to be taken; a warm bath or a good rub down with a rough towel, or both, is more refreshing and is safe. At night in the hot weather there is special liability to chills. Then the body is apt to be drenched with a profuse perspiration, and if the night clothing is not thoroughly absorbent the result is apt to be a chill.

To prevent the effects of a chill developing when unavoidably exposed to one, it is advisable to take a hot bath, go to bed, take a warm drink, an aperient and, in malarial subjects, ten grains of quinine.

For comfort and for health, the under-

To wear suitable garments next the skin day and night.

garments in warm climates ought to be loose fitting in order that there shall be a free circulation of air between them and the surface of the skin to carry off the hot vapours. They ought also to be made of material to prevent rapid evaporation and the chilling effect which this is liable to produce. Wool answers these requirements better than any other material. Wool is pleasanter and healthier than either cotton or linen, because it preserves an equable temperature around the body, and it is cooler because it permits of a healthy interchange of the gases on the surface of the body and atmospheric air. Silk has similar properties to wool; cotton and linen, on the other hand, do not absorb moisture in the same manner as wool without chilling the body, and they are only half as permeable to air; hence they are less comfortable to wear, and are not protective against chill induced by rain, exposure to a cold wind, exercise or other conditions.

It is easier to take cold in a warm climate, owing to the sensitive condition of the skin, than in cold climates where ample protection in the shape of warm clothing is provided, and the skin is not nearly so sensitive. The material to be used for under-garments should be of the finest. It should be light, porous, and loose. Coarse wool irritates the skin and conduces to prickly heat.

Prickly heat.

Prickly heat is one of the annoyances of the tropics. It is a skin eruption and is extremely itchy, but scratching only tends to make the irritation worse. It is due to excessive perspiration irritating the skin. For its avoidance the under-garments should not be irritating, and should be changed frequently. The bath should be taken regularly, and no irritating soap should be used. To allay irritation a powder consisting of equal parts of boracic acid and of starch is useful to sprinkle over the part affected after the bath. For those persons who cannot wear wool silk is a good substitute, or a mixture of wool and cotton or Indian gauze.

Use of a cholera belt.

Cellular cloth is sometimes worn with comfort, for though its fabric is of cotton it is so made as to allow of evaporation. A cholera belt, which is the name given to a knitted belt, placed round the body below the waist, and which is best made of Jaëger wool, should always be worn both by men and women. One should be worn during the day and another at night. It protects parts particularly susceptible to cold. In order that the cholera belt shall not shift its position it is best to have it attached to the pyjamas or under drawers. As long as the fundamental principle of wearing loose woollen or silken garments next the skin is practised the kind of upper garments worn is of small moment and varies much in different places. They should be loose and light in weight. The colour should be white, grey, or khaki, as these absorb the sun's rays least. Dark colours are not advisable except in the evening, and even then white is preferable. Sleeping suits and garments should always be of fine flannel or a mixture of wool and silk. When camping out a Jaëger sleeping sack, or one made out of ordinary blanket, is a great comfort and is a special safeguard against chill. During the hot weather and rains the body perspires on the slightest exertion, and it is necessary to change the clothes several times a day, and especially so before sundown. Damp clothes require to be regularly aired and dried before being put on again, and in the rains they should always be dried every night.

A warm bath after exercise or exposure to inclement weather is a means of avoiding a chill, and is at the same time refreshing.

Precautions in regard to bathing.

Europeans sometimes get into ill-health by continuing in the tropics their cold bath, to which they were accustomed in colder climates. The cold is apt to produce, especially when the body is overheated or fatigued, congestion of the internal organs. For healthy Europeans the tepid bath is as a rule not only the safer, but the more refreshing. For those suffering from bowel complaints or disorder of the liver the warm bath only should be taken, and the cold or even tepid bath is unsafe.

An important point in securing refreshing sleep and in maintaining health in the tropics

Sleep.

is the cultivation of regular habits and hours in going to bed. Late hours are most unsuitable, and if kept for any length of time are likely to induce a habit of sleeplessness not conducive to health. During sleep, especially in the early hours, the body is particularly liable to chill unless well protected by woollen garments.

Precautions to avoid infection of malaria.

The methods to be adopted for the avoidance of infection of malaria involve for their due understanding a longer description of malaria and of the manner in which the mosquito acts as the carrier of the infection. As a preliminary warning it may be well to state that no one should go to a warm climate without being provided with a good sized mosquito net of the finest mesh. It is useful in the ports at which the vessel may stay before arrival at its destination, and it is always useful on arrival until more or less settled. Fine muslin is even more protective than mosquito netting, as it excludes sand-flies as well, but on sultry nights its use is felt by some to be more oppressive than mosquito netting; when, however, there is good ventilation in the room the muslin is to be preferred.

The mosquito curtains of the bed should always be let down and fixed well before sundown in order that they may exclude from the bed any mosquitoes, which at that time enter the room or emerge from their hiding places in the room. These should not be let down so as to hang to the floor, as mosquitoes may hide under the bed ; but they should be tucked under the mattress. The lower part of the mosquito curtains for a foot or more should be made of calico, and should be double so as to shield from bites should the limbs come in contact with it during sleep.

CHAPTER II.

DIET.

Excess of animal food should be avoided.

As regards food the European has to avoid the tendency to over indulgence. A hot climate throws a strain on the liver in getting rid of effete matters, and it is not a good thing to add to that strain by eating too much animal food. Moreover, the inferior quality of the beef, mutton, fowl, and goat's flesh which is available is liable, if not taken in moderation, to disturb the digestive system. Happily the days of heavy luncheons and heavy drinks in the middle of the day are, for the most part, over, and with them have gone many of the diseases which were attributed to climate. On the other hand, it is unwise to be too sparing in one's diet, especially if there is a fair amount of work to be done. A moderate reduction in the amount of animal food and the substitution of a more liberal allowance of vegetable food, including cereals and fruits, will be found generally to be most suitable.

Meals.

It is well to conform at once to the custom of Europeans in the country, which is to take a light breakfast, or Chota Hazace, in the early morning, about 6 a.m. or 6.30 a.m., just before going out. This breakfast consists of tea, coffee, or cocoa, with bread and butter or toast or biscuit, and fruits of the season. If the work of the morning is to be hard an egg will be a good addition. A more substantial breakfast is taken about 11.30 or 12 a.m., after a bath and the full morning's work. It is usually similar to a substantial English lunch, with some preparation of rice and fruits added. Some light refreshment is taken at tea-time, and there is the dinner at night similar in its *menu* to the breakfast at noon. Those whose work is indoors usually have a lighter breakfast earlier, and a light lunch about 2 p.m. A simple fare is the best, made dishes and *rechauffés* are to be avoided, as they are likely to cause indigestion. Meat three times a day will sooner or later do harm. Except in large towns there is not much choice as to the meats obtainable.

Necessity for precautions in the selection and preparation of food.

Pork should be shunned at all times, as it is liable to be infested with parasites, the pig being a foul feeder. Beef also has to be carefully selected and well cooked, otherwise owing to containing parasites, it may be the cause of tape-worm. Beef having small bladder-like substances in its flesh should not be eaten. All supplies of meat, fish, vegetables, and fruits should be inspected when they are brought by the cook from the market. Fish should always be fresh, as indicated by the pink appearance of the gills. Tainted or putrid fish is dangerous, and is apt to give rise to poisoning and violent diarrhœa. Fruits should be eaten in the morning and for the mid-day breakfast; but it is better to abstain from them at night. They should be ripe and sound. Watercress, salads, and raw vegetables should be eschewed unless they are specially prepared and cleaned by a very reliable person, who will wash them thoroughly in water which has been previously boiled. Raw vegetables take up germs and the ova of parasites of disease from the water or soil from which they are gathered. In this way uncooked vegetables, unless properly cleaned, are apt to produce typhoid fever, dysentery, and intestinal worms. Milk in tea or coffee or as a drink requires special care. It is best always to boil the milk. Boiled milk is more digestible than unboiled milk, and as no germs can withstand boiling it is certain to be safe. In the tropics the addition to the milk of water from dirty ponds, tanks, and wells is a common practice, and as these ponds, tanks and wells contain as a rule germs of disease or ova of parasites, the drinking of uncooked milk is unsafe and dangerous. Even if water be not added to the milk, the cowshed and milk utensils are so dirty and the surroundings so insanitary that the risks of the milk becoming infected with disease germs or parasites is always present. Similar precautions should be taken in regard to goat's milk.

After the milk is boiled it should be protected from dust and flies, &c., until required, by covering with muslin. It is not enough to inspect the food as it comes from the market and insist on proper cooking; attention to the kitchen is a necessary part of the rules for retaining health in the tropics. The kitchen should be visited regularly once or twice a week to ensure cleanliness, and the cooking utensils thoroughly inspected as to their cleanliness and condition. Dishes should be washed with boiled water. When the pots require repair the native often solders them with lead instead of tin. This should not be allowed, for it is likely to cause poisoning. Food ought not to be prepared in either leaden or copper vessels.

The strictest moderation is required as regards alcoholic drinks.

A great improvement has taken place in the custom of residents in the tropics with reference to the drinking of alcoholic stimulants. Exhaustion is frequently felt in hot climates after exposure to the sun and after months of living in a sort of Russian bath caused by the high temperature of the air, the saturation of the air with moisture and the copious perspiration which the body is in under these conditions. In the early days this feeling of exhaustion used to be counteracted by the partaking of many pegs of brandy or whisky. The term peg, implying a peg in one's coffin, represented even then the conception of the general injurious results which followed from this practice. Alcohol in the tropics has a much more injurious effect on the liver and on the system generally than it has in a temperate climate, and in the days when nipping and pegging were in vogue at all times of the day, much illness was attributed to climate which was really caused by this pernicious habit. Many cases of sunstroke have been intimately connected with exposure to the sun after drinking alcohol. All alcoholic drinks should be shunned until the sun goes down. Young people going to the tropics will enjoy far better health and be better workers as abstainers. It is wiser to follow the customs of the natives of the country, who as a rule drink tea, coffee, water or sherbet. It is only when long years of residence in the tropics causes torpidity and impairment of digestion, that for Europeans, a moderate use of alcohol at dinner is of benefit. It should be taken in the smallest quantities:

2 ozs. of whisky or a pint of the lighter wines, such as claret or hock, should be the limit. Even these quantities for some persons are excessive.

DRINKING WATER.

Personal supervision required for the purification of drinking water.

It is impossible to be too particular about the purity of the water which is drunk in the tropics, and whether travelling or resident, its purification should be personally supervised. The customs of the natives are such that there is no security against contamination, whether it be river water, well water, or water stored in tanks. The same remarks apply to the condition of the vessels in which the water is collected. All waters should be looked on with suspicion, and should be subjected to filtration or boiling, or both. The diseases caused by drinking polluted water in the tropics are too many and too serious for any one to run the risk. Sewage contaminated and impure water is the medium for the spread of cholera, dysentery, enteric fever, diarrhœa, intestinal worms producing poverty of blood (ankylostomiasis), guinea-worms, and painful affections of the urinary system (Bilharzia disease).

The water should be boiled.

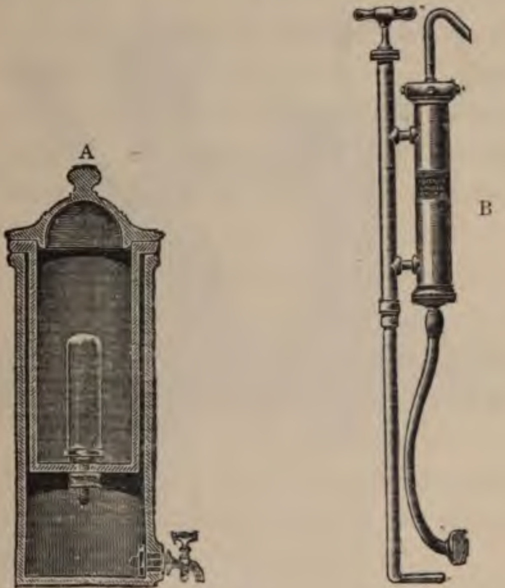
Even in the larger towns, where a public water supply is provided, though there is not the same necessity as in other parts of the country, where water is liable to all forms of pollution, yet it is still advisable to boil and cool the drinking water. After boiling, care must be taken to store the water in a clean vessel, and to protect it from any contamination in the process of cooling. The vessel should be covered by clean muslin. The cooling may be effected by wrapping a wet cloth around the vessel and exposing it to the air.

If filtered, kinds of filters that should be used.

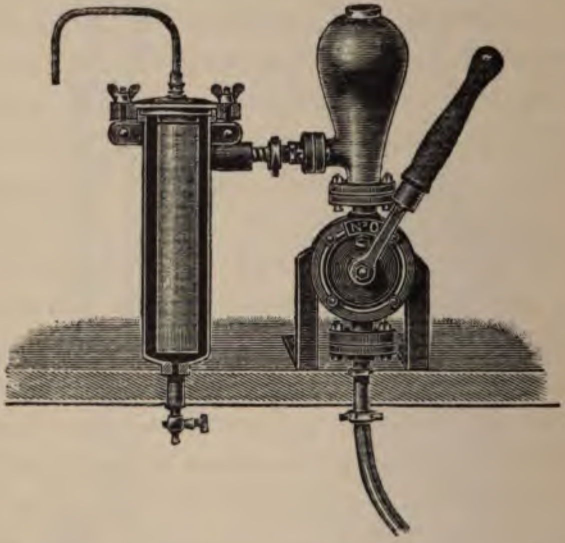
Next to boiling, filtration is the only other fairly safe method of treating the water before drinking. The best filters for this purpose are the Pasteur-Chamberland filters, of which there are several kinds, portable and convenient in size. The Berkefeld is also a good useful filter. All other kinds should be discarded, for they are difficult to keep clean, and instead of purifying not infrequently add their own impurities to the water. The only exception to this is when dealing with the muddy waters of rivers. These will clog up the pores of a Pasteur-Chamberland or Berkefeld filter, and render them useless in a very short time. Under these circumstances a rough filtration to get rid of the suspended matter and mud in the water is necessary before attempting to pass it through the Pasteur-Chamberland or Berkefeld.

For this rough filtration charcoal, asbestos, magnetic carbide, spongy iron, polarite sand or other similar filters can be used. Even these, however, must be regularly cleaned, and should be boiled at least once a fortnight. The Pasteur-Chamberland filter is composed of a special porcelain-like material, shaped in the form of slender tubes or candles, which are hollow. Each tube forms a filter in itself, and can be used as such if there is sufficient pressure of water.

The Berkefeld filter is on the same principle as the Pasteur-Chamberland. It consists of diatomaceous earth made into a thick instead of a thin cylinder, and allows of water being filtered more rapidly. It has the disadvantage, however, of being more brittle than the Pasteur-Chamberland. The diagram shows two of Berkefeld's filters. Of course, the greater the pressure of the water, the faster the water passes through the tubes. Care, however, has to be taken that the tubes are protected, for they are easily broken. For this purpose



single tubes are encased in metal, or enclosed in a glass jacket. The filter thus shielded may be fixed on the water taps of a house, or for travelling may be attached to a hand-pump, as in diagram B, or in a house it may be pumped from a well through the filter as in fig. C. The water passes through the Pasteur-Chamberland and the Berkefeld filters from without inwards, and much more water is given by the latter filter than the former



under the same pressure. As water, even under pressure, passes very slowly through a single tube, a number of tubes are placed in one filter to secure a quicker and larger supply of water.

On a larger scale an installation of tubes may be used to filter the water direct from a well, or from a river, or any reservoir of water.

The special appliances belonging to these large filters supply the requisite pressure for the filters.

The filter candles should be cleansed by brushing off the material which has collected on them, and then boiling or baking them for an hour. This should be done once a week. If the water to be filtered has much suspended matter the brushing may require to be more frequent, but there is no need of repeating the boiling or baking.

Treatment of muddy and turbid waters.

When there is no rough filter to clear a muddy water, or the filter is not effective, a preliminary addition of alum, in the proportion of six grains to every gallon of water, will in a short time clear the fluid, the impurities gradually falling to the bottom of the vessel. The clarified water can then be decanted, filtered and boiled. If the water is boiled first and then filtered there may be a danger of the boiled water becoming contaminated unless care is taken. When travelling, a quantity of permanganate of potash in crystals is always a very useful chemical to be provided with, in addition to alum. It is particularly useful in getting rid of the disagreeable smell of some waters. It possesses the power of destroying organic matter, and thus rendering water more drinkable. A few grains of permanganate of potash added to a vessel of dirty water produces a pink tinge which gradually disappears. The pink tinge will disappear more quickly when the water is heated. If the process of alternately adding a few grains of the permanganate and heating is continued until a pinkish tinge remains for ten minutes, much of the organic matter is destroyed, and the water can then be boiled and cooled.

Tea and Coffee.

If personal supervision cannot be exercised over the purification of the drinking water, it is better always to drink tea or coffee, toast and water, lemon decoction, rice water or barley water rather than water. These being all made with water which has been subjected to boiling, are free of living germs of infective diseases. Care, however, must be taken that the cooling and storage of these drinks do not expose them to contamination.

Ice and Soda-water.

In using ice or soda-water, only supplies from the most unimpeachable sources should be employed. Either of these obtained from native sources are generally dangerous. Soda-water kept for a fortnight appears to be safer than fresh soda-water if the source is doubtful.

Iced drinks should only be taken sparingly, for in excess they tend to weaken the digestive processes, which are already somewhat impaired by climatic conditions. Similarly, drinking large quantities of fluid, even if only water, should be avoided. Excess of fluid is a cause of dilated stomach and dyspepsia in Europeans in the tropics.

CHAPTER III.

Dwelling House.

A house close to native huts unhealthy.

There are certain important points in connection with dwelling houses in the tropics which should be borne in mind when either leasing or building a house. First, the houses should not be surrounded by nor close to native huts. Native children are seldom not infected with malaria, and hence living in a dwelling house in this position increases the risk of infection from that disease. For this reason a dwelling house among native huts is an unhealthy house, apart from the fact that it will also always be in the midst of other insanitary conditions.

Site must be dry.

Secondly, the house should not be near to stagnant water, nor situated on a low-lying site where the water does not readily drain away, nor exposed unsheltered to the chilling air in a ravine. An elevated and dry site on sloping ground, but not in a hollow, should always be chosen as far as possible. Even in a hilly country a site may be unhealthy if in a hollow surrounded by hills which impede ventilation and favour stagnation of air.

Two-storied houses preferable.

Thirdly, the rooms of the house should always be raised well above the surface of the ground. A two-storied house in which the sleeping apartments are upstairs is likely to be a more healthy house than that which is single-storied.

Rooms should be high.

Fourthly, the rooms should be high, and there should be an air space between the ceiling and the roof.

Fifthly, there should always be a verandah; and sixthly, the servants' quarters should be well away from the house, but within the compound, which should always be large, in order that the house shall secure around it a free circulation of air.

Precautions against erecting a damp house.

In building a house or hut the foundations require a concrete or other impermeable basement, to exclude damp and impure ground air. Raising the house on pillars and arches in addition affects this even more thoroughly by permitting free ventilation underneath. The walls will otherwise become damp by drawing up moisture from the soil. An ordinary brick will hold about 16 ozs. of water. To prevent this saturation of the lower wall of a house a damp proof course is not only required in the foundations but for at least a foot above the surface of the ground, and below the lowest timbers or floor-supports. The damp-proof course can be made of any impermeable material which is at hand, and which is suitable for a building. If nothing better can be obtained, tarred bricks are useful. The bricks are first heated and then plunged into a bath of boiling tar, and then rolled in dry sand.

The walls should also be protected as much as possible by overhanging eaves.

Every house should be surrounded by a well-constructed drain to carry off the water streaming down the walls during the rains, and prevent soakage causing dampness of the walls, or the formation of puddles which would harbour mosquitoes. It should also have a space of ten or twelve feet which is paved, tiled or well consolidated with vitrified brick, and which is sloped away from the basement. A belt of sharp gravel beyond this is an obstacle to snakes. Short grass beyond this is the most suitable and most healthy kind of vegetation to be near a house. Trees ought not to be so close as to obstruct the ventilation or tend to make the house damp.

Coolness obtained by ventilated air space between the roof and ceiling.

Coolness is obtained by having double ceilings and double roofs. The air space between the ceiling and the roof interposes a layer of air and lessens the radiant effect of the heat from the roof to the room. The air space should, however, have communications with the outer air, so as to secure good ventilation.

Low ceilings always render a room oppressively hot, and should therefore be avoided.

Corrugated iron must be lined with felt or wood or both.

The materials used for the building of a house will depend on what is obtainable in the district. Stone or brick is of course the best, but wood and corrugated iron make comfortable houses. If corrugated iron is used it should be lined with felt if obtainable, and close boarding. Without these, whether used for the whole structure of the house or only for the roof, corrugated iron will be found to be unsuitable. During the intense heat it will not be sufficiently protective, and during the cooler weather it will not be warm enough. Roofs of bamboo frames with local thatching of palm leaves, long grass, etc., are cool, but they harbour vermin.

Coolest houses are those with interior courtyard.

The coolest kind of houses are those built with a courtyard in the centre. They allow of every room being freely ventilated, and if the courtyard is covered at the top with mosquito wire netting it is a pleasant place to sit in the afternoon and evening. Whether built with a court-yard or not, every house in the tropics should have a good-sized verandah, either all round or on the most sunny side. It adds to the coolness and comfort of the house, and also protects the rooms against the direct solar rays, and against beating rain. If the verandahs are going to be used for dining in or sitting in of an evening, they ought, if in a malarious district, to be protected by wire gauze netting to prevent mosquitoes gaining access to them.

Bathroom.

The bathroom may be either detached from the house and approached by a separate verandah, or it may be a separate room of the house approached from the verandah. In either case it is usual for it to contain a commode or an earth closet. In the event of a commode being employed it is taken away and emptied immediately after use into a small covered receptacle kept in a special shed in the compound. The contents of this receptacle are then either taken away by the local authorities daily or they are buried in the garden. This burial must be done with care, and the surface properly levelled, so that no puddles may be formed during the rainy weather.

Tanks to store roof-water.

If water is not obtainable from a well, or if obtainable is not good, it will be necessary to collect rain water for drinking purposes from the roof. This always presupposes a roof other than thatch. If water is collected from the roof it is preferable to store it in galvanised iron tanks or in masonry tanks. Wooden tubs and vats should not be used. The tanks should be at the side of the house, and not underground, and they should always be covered with a lid, between which and the water should be a mosquito wire netting to protect the stored water from mosquitoes and insects. The inlet pipes from the roof to the tank and the over-flow pipe from the tank should be protected with the finest copper wire gauze netting, of at least 100 strands to the cubic inch. They should be cleaned regularly before the rains. The first water falling from the roof should be discarded, as it brings with it the impurities which have collected on the roof during the dry weather.

Servants' quarters.

The outhouses and servants' quarters should be well away from the house. The kitchen only should be near, and if possible connected by a covered passage. The same principle of building to secure dryness, drainage, coolness and cleanliness apply to them. While building it is just as easy to construct the servants' quarters of the same material as the house, but if this is impossible, mud huts raised on a good concrete plinth, if properly lighted and ventilated, make comfortable dwellings.

CHAPTER IV.

ILLNESSES OF THE TROPICS AND THEIR PREVENTION.

Prevention of bowel complaints.

IT would be impossible to deal with the numerous diseases of the tropics in a handbook such as this. It may generally be said, however, that if the purity of the drinking water and milk be secured, the wholesomeness and cleanliness of food attended to and chills are avoided, digestive troubles and bowel complaints, to which there is much tendency in the tropics and which form, next to malaria, the most frequent cause of ill-health, will as a rule be prevented. The rules, as will have been noted from what has already been stated, are simple, and can be carried out easily by anyone. There are certain special diseases, however, which are preventible, which it is desirable to say something more about. These are malaria, yellow fever, dysentery, cholera, plague, and diseases of the liver.

MALARIAL FEVER.

MALARIAL fever is perhaps the most important disease of the tropics. It is widely prevalent, it causes many deaths, invalids in large numbers, and weakens the vital powers to such a degree that the sufferer from malaria is peculiarly liable to be attacked by other diseases.

Different types of malarial fever.

There are several forms of the disease. In one the fever attacks come on regularly every twenty-four hours, with an interval of ten or twelve hours of freedom from fever; in another they occur every forty-eight hours, with one day or less of freedom intervening between the attacks; and in a third they come on every seventy-two hours, with two days of natural temperature between. These types may vary to some extent, so that the kind of fever represented is only recognised by the physician. The symptoms also vary, but in general each attack is distinguished by a cold stage, a hot stage, and

General symptoms.

a sweating stage. The cold stage may last from a few minutes to two or three hours. The patient begins to feel cold, and seeks warmth by extra clothing, or exposure to the sun; he then shivers, sometimes but slightly, at other times violently. He has headache, pains in the limbs and loins, is thirsty, and vomits. After this stage has continued for some time, and no amount of clothing makes the patient feel warm, transitory flushes alternate with the shivering or feeling of chilliness, the feeling of cold diminishes, and then the face becomes flushed, the skin hot and dry, the pulse strong and rapid, the headache increases, the vomiting may become more distressing, and there may be delirium and, in children, convulsions. The temperature if taken will be found to be 103° or even higher. This is the hot stage, and may last from two to eight hours or longer. It is followed by the sweating stage, in which the patient perspires profusely, the feverish symptoms subside, the headache passes off, the thirst lessens, and the patient, exhausted, falls into a sleep, from which he awakens free from fever. This freedom from fever continues until the next attack is due.

Causation of malarial fever a parasite in the blood.

The disease in its several forms is caused by a minute parasite, which gains an entrance into the body and lives in the blood of the patient. The blood is made up of red and white corpuscles floating in a clear fluid. This parasite, which was discovered by Laveran, a French physician, in 1880, attacks the red corpuscles of the blood and destroys them, and were it not for the natural resisting powers of the body, which fight against the parasite and its poison, and for the fact that the parasite is affected by medical treatment, the patient would never recover. When the parasite enters the red corpuscle of the blood, it is comparatively small, but it soon undergoes changes, at the expense of the red blood corpuscle; it increases in size, and occupies a considerable proportion of the corpuscle. It then becomes segmented or rosetted, each segment acquiring a spherical form. Finally, the corpuscle breaks down, and allows the segments or spores to escape into the blood-stream. Each spore being free, is now ready to attack another red corpuscle, to undergo the same development, repeat the cycle, and discharge another brood into the blood-stream. It is when the young spores of the parasite become free in the blood that they are open to attack. Then there may suddenly appear on the scene and in a state of great activity certain white corpuscles that rush on the young brood of parasites, attack, absorb and digest them. A similar destruction of parasites goes on in the liver, spleen and marrow.

Manner by which the parasite gains an entrance into the blood for a long time unexplained.

Until a few years ago no explanation could be given as to the manner in which the parasite gained an entrance into the blood. There were general views of its being taken into the system by the lungs from the air, or by the stomach from swallowing water infected by the malarial parasite. These views have, however, proved to be wrong, and it remained for Sir Patrick Manson to direct investigation into the true channels by which infection is brought about. It had been noticed that when the fever continued for a few days that the parasite instead of breaking up into spores, in some of the corpuscles formed a crescentic body, that this crescentic body, which seemed to be a maturer form of the parasite, when removed from the blood vessel, gradually assumed a spherical form, threw out from its circumference several whip-like or thread-like projections, which wriggled actively and then became detached and free.

Observations leading up to the explanation.

Sir Patrick Manson, watching these changes, came to the conclusion that the parasite, like others of the same class, had a further development in some other host, probably an insect, and that that insect was the mosquito. The hypothesis met with a good deal of ridicule at first, but Major Ross, a medical man in the Indian Medical Service, set himself the task of investigating the truth of Sir Patrick Manson's theory. Major Ross was soon able to show from experiments with birds suffering from malarial fever that mosquitoes were the intermediate host, and that Sir Patrick Manson was right in his views. Major Ross proved that when a certain kind of mosquito bit these malarial birds the mature malarial parasites contained in their blood were sucked up and swallowed, and were found in the stomach of the mosquito. There the mature forms soon underwent a change. Some threw out whip-like wriggling processes, others small protuberances, and by the union of these an egg-cell was formed. This egg-cell, first assuming a worm-like shape, bored its way through the stomach wall of the mosquito, then it changed its shape and became round, and increased much in size. After this changes were noticed to take place inside the cell, and finally countless needle-shaped spores or germs were seen in the interior. The cell when mature burst, and the spores escaped into the different organs of the body of the mosquito. Some of these needle-shaped spores found their way into the salivary gland of the mosquito, which is connected by a duct with the proboscis of the insect, and in this way were transferred to the blood of healthy birds which were bitten by these mosquitoes. Major Ross was able to show the whole process from the beginning to the end. The process takes about eight days for all its stages in the mosquito, and he was able to give birds malarial fever by getting infected mosquitoes to bite them.

The anopheles mosquito proved to be the agent.

It was no long step from this complete demonstration of the part which the mosquito plays in causing the malarial fever of birds to the proof of its rôle in the production of malarial fever in man. Grassi, an Italian naturalist, showed that among the many different kinds of mosquitoes in Italy, one kind was always found in malarial districts. This was the anopheles. Acting on this information, Bignami, an Italian physician, determined to test the effect of the bite of mosquitoes of the anopheles kind, brought from a malarious district, on a healthy man. A man who had volunteered on a previous occasion to a similar experiment, which had failed, again offered himself. This time the experiment succeeded, with the result that the anopheles infected him with the same type of malarial fever as that prevailing in the district from which the anopheles were brought.

The positive evidence thus obtained that a healthy man could be infected with malarial fever by infected mosquitoes brought from a distance was confirmed, and rendered still more positive, by some further experiments carried out by Sir Patrick Manson. Dr. Bignami's experiment was always open to the objection that as the healthy man who volunteered was living in Italy, he might have contracted the fever in some other way than by the mosquitoes which bit him. This objection was removed by Sir Patrick Manson's experiment. He had some infected anopheles brought from Italy to England. His son, Dr. Thurburn Manson, and Mr. R. Warren, of the London Tropical School, volunteered to subject themselves to the bite of the anopheles. Neither had ever been in a malarial country, nor resided near a malarial district. It is obvious that if the experiment were successful the evidence was complete. The experiment was carried out and proved successful. Both Dr. Manson and Mr. R. Warren were attacked with malarial fever eighteen days after they were bitten, and the parasites were found in their blood.

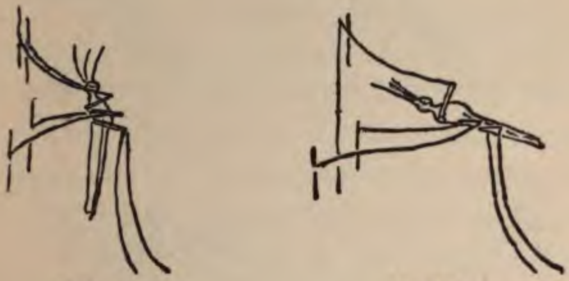
It is important for measures of prevention to know what kind of mosquito this anopheles is, and to be able to recognise it in its different stages of the winged insect, the egg, the larva and the pupa. No other species of mosquito, of which there are many, are malaria-bearing, so for malaria at all events they need not be considered. The great thing is to be able to recognise the anopheles. In considering the four stages of existence of the mosquito it is necessary to remember that the winged insect spends its life in the air, the egg floats on the water, and the larva and pupa pass their life in the water.

Description of the anopheles and its life history.

The anopheles is a winged insect, from the front of whose head projects a central straight proboscis of a stiletto-shape. On each side of the proboscis and almost in contact with it are the palpi, of about the same length; on each side of the palpi are the antennæ, or feelers. The body is slender, the legs are long and slender, and the wings are small and may have four spots on their front margin. It is recognised by the

Winged stage.

position it assumes when it rests, and by being noiseless on the wing; it never hums. It rests on the wall on its long legs, with its body sticking out behind at an angle to the wall of 45° or 50°. Its proboscis almost touches the wall, and is in the same axis as its body. Proboscis and body are in the same straight line, and form an angle with the wall to such an extent sometimes as to make them almost vertical to the surface. This is a characteristic attitude, and differs from other kinds of mosquitoes which, when resting on the wall, have their proboscis curved and at an angle to the body, and not in the same axis, so that



Culex. *Anopheles.*

FIG. 1.—Mosquitoes resting on a wall (Ross).

they have a curved or hump-backed appearance, unless lying flat against the wall. The contrast in attitude is shown in fig. 1 and fig. 2. Fig. 1 shows the mosquitoes resting on a wall. Fig. 2 shows them resting on a horizontal surface. The difference is very striking. The anopheles never lies parallel with or flat against the wall. It is always at an angle, with its body sticking well out from the wall.

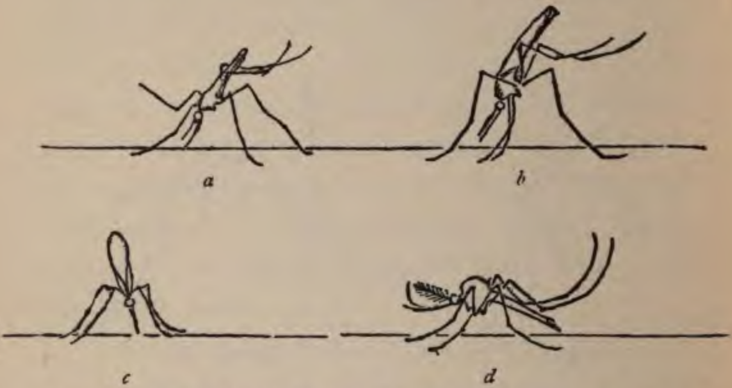


FIG. 2.—*a*, *b*, *c*, Anopheles, and *d*, Culex, mosquitoes resting on a horizontal surface (Giles).

The eggs of the anopheles, unlike those of other mosquitoes, require a lens to be dis-

Egg stage.

tinctly seen. They are then seen to be boat-shaped, and are single, or arranged in small groups, and generally attach themselves to floating objects in the water.

Larva stage.

The larvæ of the anopheles have a small head, and long, segmented, tapering body. The head is narrower than the first segment of the body, which is called the thorax. Down the centre of the body run two breathing tubes, which end in two openings in the front part of the last segment. It is because of the position of the breathing tubes that the larvæ of anopheles usually float horizontally at the surface of the water, differing in this respect from the larvæ of other mosquitoes, which have their breathing tubes ending in a long process or flap near the end of the tail, and rest with their heads down in the water, and this flap near the tail only at the surface. Mosquitoes, the larvæ of which hang down in this way, are not malarial breeding. They are the most numerous mosquitoes in the summer. Fig. 4 gives the position which these larvæ assume

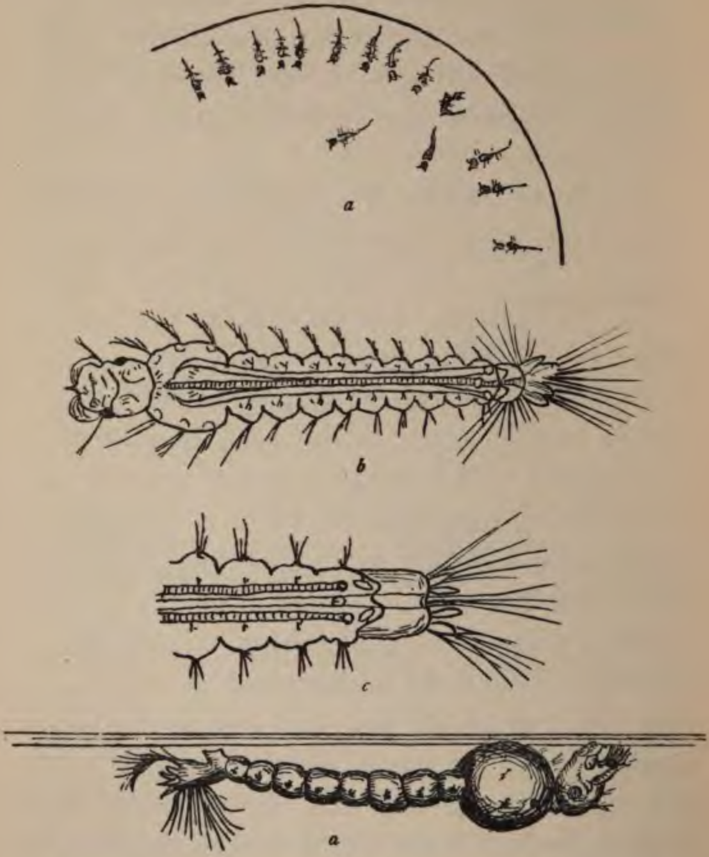


FIG. 3.—Larvæ of Anopheles. *a*, Natural size, floating at surface of water; *b* (magnified) showing breathing tubes; *c*, section (magnified) showing openings of breathing tubes near tail (Christy). *d*, Position at surface of water (Giles).

in the water and also show the position and termination of their breathing tubes, which explain their attitude in the water. When anopheles larvæ are disturbed, they usually skim along the surface of the water, and seldom go to the bottom. When the larvæ of culex are disturbed they quickly go to the bottom.

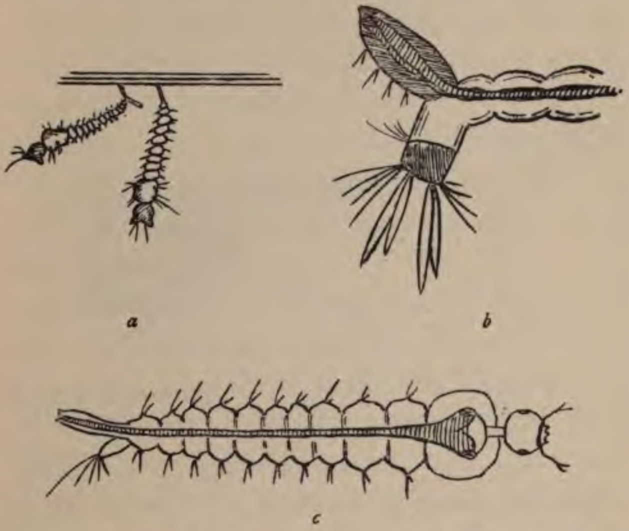


FIG. 4.—Larvæ of Culex. *a*, Enlarged, showing position of rest at surface of water; *b*, section showing opening of breathing tubes near tail; *c*, showing breathing tubes (Christy).

Pupa stage.

In the course of one to three weeks the larva develops into the pupa. The pupa is shaped like a comma or a sea-horse with a swollen head. It has a paddle-like tail by which, with a series of jerks of its abdomen, it swims rapidly. It has two trumpet-like tubes proceeding like horns from the sides of the thorax. These are the air tubes. In a state of rest the pupa remains immediately under the water, with

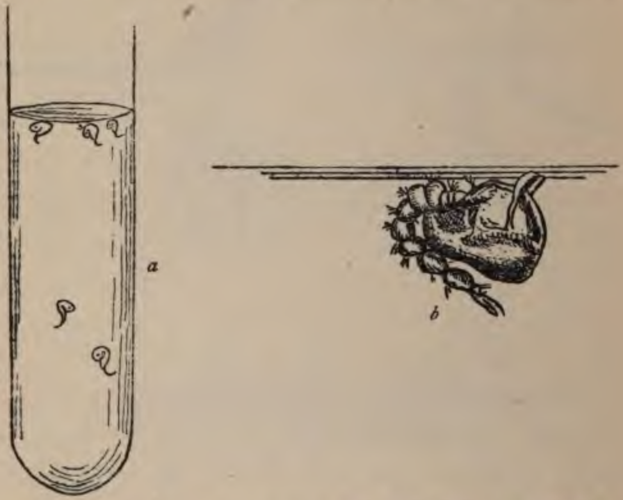


FIG. 5.—The nymphæ or pupæ of Anopheles. *a*, Natural size (Christy); *b*, magnified (Giles).

these two air tubes touching the surface. The pupa thus breathes through these tubes near the head instead of through the tail, as the larva does. In two or three days the thoracic part of the pupa splits, and there emerges from it the winged insect, which remains on the surface of the water, resting on the remains of the pupa until it is enabled to unfold its wings and fly away. Male and female thus take wing, and in this stage the female becomes fertilised, and lays her eggs, generally in the same waters from which she emerged.

Mode of infection of the mosquito.

In the meantime, during the life of the mosquito as a winged insect, the female feeds if she can on the blood of man or beast, and if that blood belongs to a malarial patient with the mature forms of parasites in the red blood corpuscles, the mosquito which was healthy before becomes an infected mosquito, and in eight or ten days, when the development of the parasites within are complete, she will infect any healthy person whom she bites. It is only the female that bites, and it is only the female that can convey malarial infection, for it is in the female alone that the parasites undergo the wonderful development already described. She is for the most part a nocturnal creature, and seldom feeds at any other time than between sunset and sunrise. The female anopheles is not always the carrier of the malarial germ, for unless the anopheles feeds on infected blood it cannot become infected and cannot give malaria. As a new born anopheles it is harmless until it has fed on a malarial patient.

Mode of infection of human beings by the mosquito.

The conveyance of malaria from a malarial patient to a healthy person by an infected mosquito places malaria in the rank of an infectious disease. In a malarious district the anopheles has plenty of opportunities of becoming infected. Large numbers of the children, especially under two years of age, have parasites in their blood. This is especially the case among natives. It is because of this fact that Europeans living near native huts incur the risk of being infected with malaria. The anopheles finds in the unprotected native children a happy hunting ground for nourishment. Those anopheles which feed on malarious children become infected, and then entering the European houses in search of fresh food, infect by their bites the European inmates, as well as the native servants. The native children get infected by the anopheles that have fed on the blood of their fathers, mothers, sisters, brothers, other children, or visitors coming from an infected locality, who have been suffering from malaria due to a first infection, or to relapse of their fever from a former infection, and which has been brought about by chills or other causes.

Preventive measures.

Such is the history of malaria. It is not absolutely certain whether it is the whole history, or whether the mosquito may become infected with the malarial parasite from certain animals and then convey it to man, but sufficient is now known to state that the anopheles and the anopheles only is the carrier and the disseminator of malaria. It is therefore on this knowledge that all preventive measures against malaria have to be based. Who would ever have thought a few years ago that malarial fever was infectious? Now it has been proved to be so. A patient suffering from malaria is a source of infection to all in close association, with him, and even to his neighbours.

Protection of a malarial patient from the bites of mosquitoes.

Unless such a patient is protected from the bites of mosquitoes until he is well, the anopheles will suck his blood and swallow with it the parasites that it contains, and in eight or ten days inject some of them into the first person she bites. Accordingly, it is necessary in the first place to protect a patient suffering from malaria by a mosquito-net. This protects the patient from being reinfected by other infected anopheles, and it prevents any healthy anopheles being infected by him. The mosquito-net should have a very fine mesh, at least 20 to the inch, because the anopheles are small and very active, and soon get through ordinary netting. It ought also to be hung from the inside of the frame which is supporting it, so that the poles may not interfere with its proper adjustment. The mosquito-net must not fall on to the floors, as mosquitoes may then hide under the bed, but be tucked under the mattress.

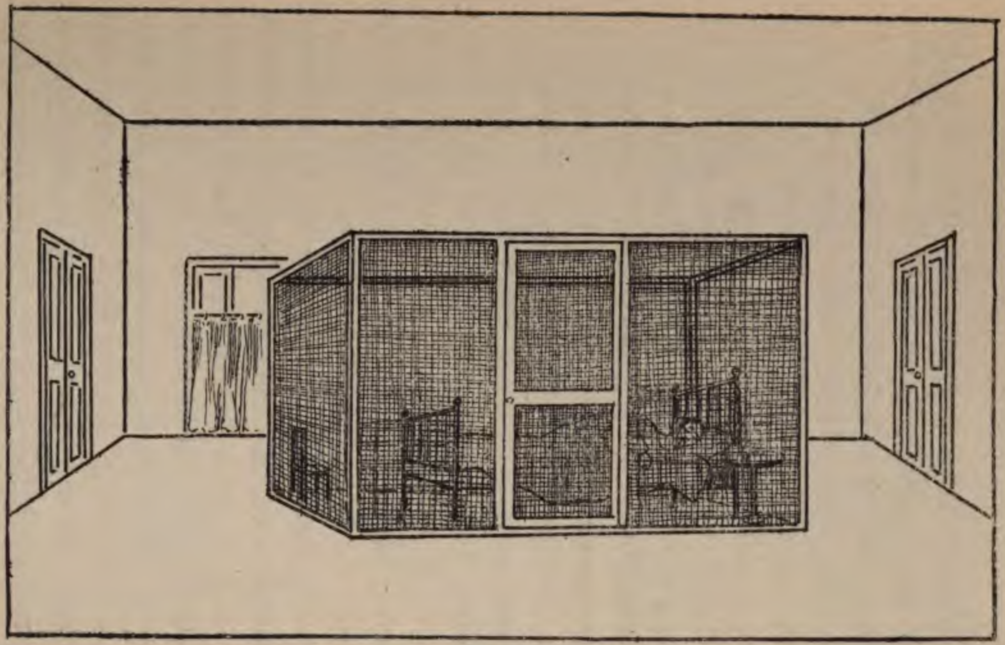


FIG. 6.—A Mosquito House, inside which is placed the bed.

The mosquito curtain, however, may not always be effective, owing to the arms during sleep perhaps coming in contact with the curtain. To avoid this, the lower part of the mosquito-net for a foot or more should be of double calico. A better and more convenient mosquito-net protection, whether for a sick person or those who are well, is a mosquito house, occupying the best part of the room, and inside of which is placed the bed. It consists of a slender frame of wood and mosquito netting of small mesh tightly stretched across the frame at the sides and top. It has a door with a spring to secure its always being kept shut. It resembles a large square tent.

The protection of healthy people against bites of mosquitoes.

The proof that people can live in malarious districts without contracting malaria was first demonstrated in the malarious districts of Italy. There, in its most malarious parts, Professors Celli and Grassi had certain railway labourers' cottages and peasants' reed huts protected from the invasion of mosquitoes. This was done by fixing on the

Italian experiments.

windows and other openings wire gauze netting, and by placing at the door or entrance a wire netting cage or corridor with double doors (figs. 7 and 8). The mosquitoes already inside the house were destroyed by fumigating the rooms with burning sulphur or other fumigating substance. Quinine was also given to those persons who showed signs of a relapse from a previous attack. The results of these experiments were highly successful. Only a few out of several hundreds living in the protected houses and huts were attacked with malaria, which was in striking contrast to the inmates of neighbouring unprotected houses, who were nearly all attacked. The few who were attacked appear to have not conformed strictly to the rules, which consisted in always being indoors between sunset and sunrise, and if obliged to go out at night, to wear thick gloves and veils. The object of keeping within the protected house or hut between sunrise and sunset is to avoid being bitten by the anopheles, which feeds between these hours.

The most rigidly scientific experiment was

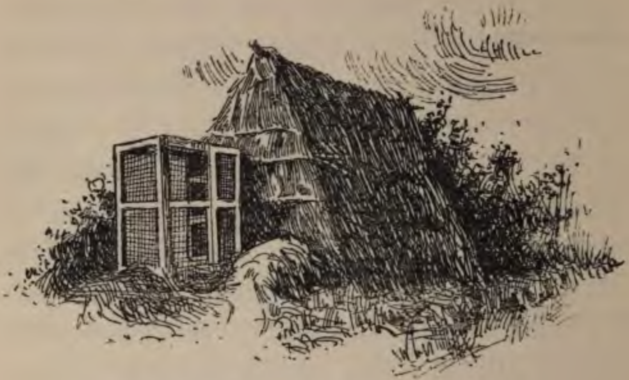


FIG. 7.—Mosquito protected hut (Celli).

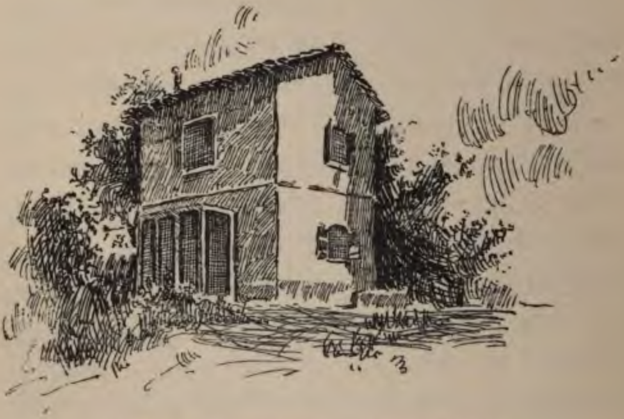


FIG. 8.—Mosquito protected house (Celli).

British experiments.

that carried out by Drs. Low and Sambon, of the London Tropical School, who were sent out to the Roman Campagna by Sir Patrick Manson, on behalf of the Colonial Office and the London School of Tropical Medicine. Assisted by the Italian authorities they erected near the mouth of the Tiber a hut whose windows and doors were covered with wire gauze (fig. 9). In this hut Drs. Low and Sambon, with two others, lived for three months during the malarious season, and the only rule they conformed to and the only precaution taken was to be within doors before sunset. They spent the day in

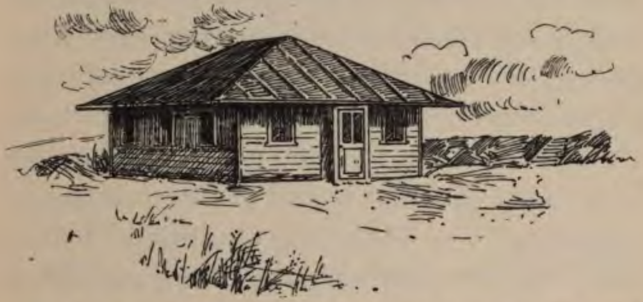


FIG. 9.—Mosquito protected hut in Roman Campagna for British Mission.

scientific excursions in the neighbourhood. All four persons in the hut remained absolutely free of fever. While the experiment was being carried out sixteen police came down to Ostia to arrest some anarchists. They spent but one night in the malarial district, but this was sufficient exposure, for every one of them was attacked with fever a fortnight later.

Since these experiments great advances have been made, and the policy of protecting the houses by mosquito wire netting, and fumigating the houses, is extending rapidly and successfully in the malarial districts of Italy.

Protection of the house.

It is accordingly by the protection of houses from mosquitoes that one of the most important means of protecting healthy persons from mosquito bite is attained. This protection of houses already built consists in carrying out two measures. The first is to place copper or brass wire mosquito netting of a mesh of at least 20 strands to the square inch, on the windows and doors of the house, and the second is to fumigate the house to destroy the mosquitoes. The kind of pro-

(a) Mosquito wire screens.

tection by wire netting is already indicated in the illustrations of the experiments described.

Where it is the custom to sit out in the verandah of an evening it is necessary to protect them by wire netting.

The Anopheles is a domestic creature, and takes up its abode mostly within the house or hut where it can most easily obtain its food. The protection of the house from mosquitoes includes the cellars, if any, or the lower basement, which is often used for stores. These must not be forgotten, for, being generally dark and devoid of ventilation, they are often the hiding places of the mosquitoes during the day. Mosquitoes love darkness and moisture.

(*b*) Fumigation.

Besides protecting the doors and windows of the house by wire netting the mosquitoes inside the house should be destroyed. This may be done by fumigating the house with sulphur, the flowers of various species of pyrethrum and chrysanthemum, or by tobacco smoke or wood smoke. Tobacco smoke has been found to be the most fatal to mosquitoes, but it requires a larger amount than could be generated by large numbers of people smoking in a small room. The burning of the powder of the Dalmatian chrysanthemum or pyrethrum is much more practicable, if vegetable insecticide powders are to be used, and if not, then it is better to fall back on the burning of sulphur. The latter, however, has disadvantages in the irritating gases which it generates. Sulphur burnt in an iron pot placed in a tub or basin of water to prevent the burning sulphur falling on the floor can be used, or pyrethrum powder, which has been damped, formed

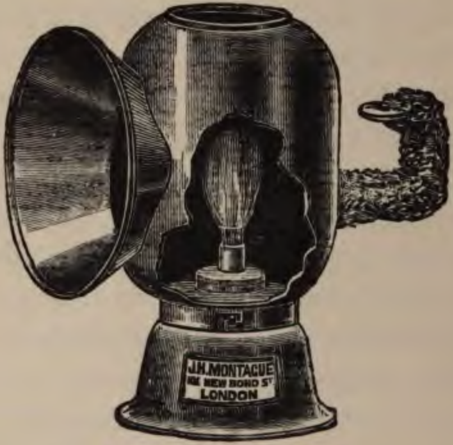


FIG. 10.

into a cone or pastille and then lighted, or powdered cineraria, one tablespoonful of which should be mixed with nitre and burnt, or if none of these can be had, then burning wood and filling the room with its smoke, will all be found to be useful. After fumigation any stray mosquitoes can be destroyed by flapping them with a towel or duster. A chinese lantern similar to that in fig. 10 is useful for destroying mosquitoes. The funnel-shaped opening when placed over the mosquito resting on the mosquito netting or wall imprisons the mosquito, which, in endeavouring to escape, gets cremated by the flame inside.

(*c*) **Living in a house well away from native huts and houses.**

In building a house in a malarious district a site should be selected well away from native huts. It has already been stated that a large percentage of native children have malarial parasites in their blood and that native huts abound with infected mosquitoes. It is important, therefore, that the house should be removed from this source of infection besides being protected in the other ways mentioned.

With the protection of the house the principal centre of infection is removed. This, however, is not sufficient. Social and other functions will take people out of doors after sunset. Protection from bites of mosquitoes in malarious districts must then be obtained as far as possible, if in a carriage by wraps around the feet and ankles, and if walking by wearing boots instead of shoes, and by wearing large veils and gloves. The veils may be such as are worn while motoring. Veils are useless if drawn tightly across the face. It is advisable to wear putties when out camping or shooting in malarious districts, they prevent mosquitoes biting the legs. If ladies do not care to wear putties they should wear kid boots with long tops.

Protection of the individual outside the house at night.

These simple means of protection should be supplemented by other methods to rid the surroundings of the house of mosquitoes. This can be done by destroying the larvæ which spend their life in water. As the mosquito always lays its eggs on water, and the larval and pupal stages

The methods described must be supplemented by destruction of the larvæ and pupæ of mosquitoes.

of its life are spent in water, it is evident that all exposed surfaces of water round about the house are the breeding places of mosquitoes. It is these, therefore, that require attention; moats, ditches, obstructed and unflushed drains, tanks, ponds, reservoirs, cisterns, barrels, pots, tubs, broken bottles, or other receptacles containing water, especially if this water is stagnant, serve equally well for the larval life of the mosquito. Pools and puddles formed during the rains by excavations or uneven surfaces of the ground, are soon full of mosquito larvæ. On the other hand, without water it is impossible for the eggs, the larvæ, and the pupæ to undergo development. The surest mode for their destruction is to deprive them of water. The adult mosquito may hibernate or lie dormant for a long period; but this is not the case with the eggs. The larvæ also may remain for a long period in a resting or dormant stage in water which is not suitable by reason of its temperature for development into pupæ; but neither larvæ nor pupæ can live without water. If they

Breeding places of larvæ and pupæ.

do not get water they die. The larvæ are usually found in ponds, small watercourses, and ditches at the margins where the water is still and where weeds abound, and they are not generally found in large bodies of water, such as marshes, lakes, and rivers. Fish are the enemy of the larvæ of mosquitoes, so that water well stocked with fish do not, as a rule, breed mosquitoes. It is the small puddle near the house that is generally the most dangerous breeding place for malaria.

The shortest period of the water life of the mosquito is a little over a week.

The shortest period under most favourable conditions for the eggs to pass through the larval and pupal stages is a little over a week. The puddles and pool may, therefore, remain untouched for that time at least without giving rise to the winged mosquito. This fact is made use of in preventive measures against the development of mosquitoes.

Measures to be taken to destroy the larvæ and pupæ.

Preventive measures may be summed up as regular attention to the local conditions surrounding the house. Every week pots and other receptacles containing water, and therefore liable to be the breeding places of mosquitoes, should be emptied and dried; the drying may be done either by wiping with a cloth or exposure to the sun. Puddles should be brushed out with a broom. Cisterns and reservoirs containing water which can be spared should be emptied; but if the water is too precious for them to be emptied they should immediately after the periodical cleaning, to which all should be subjected, be protected by mosquito wire netting. Other reservoirs too large to be emptied should be treated by having added to them petroleum or kerosene. It has already been pointed out that the larvæ and pupæ of mosquitoes come to the surface of the water to breathe. If a thin film of petroleum or kerosene is spread over the surface of the water the larvæ and pupæ are unable to obtain the air they require.

Emptying of receptacles containing water, and brushing out puddles.

Use of mosquito screens for water reservoirs and cisterns.

Spreading a thin film of oil on the surface of the water.

They get suffocated and drown. The oil can be spread by a rag on a stick. The disadvantage of petroleum is that it soon evaporates. Tar has greater advantages in this respect, and an old tar barrel placed in the reservoir or tank gives a better film for a longer period. The barrel can be taken out and retarred as required—once a fortnight is probably sufficiently often. In the case of a tank of drinking water the film may be formed by eucalyptus oil, which evaporates even more quickly than petroleum. The mosquito netting is, however, the best protection for tanks or reservoirs containing drinking water.

Filling up the excavations and depressions, and levelling and draining uneven surfaces.

All excavations around and near the house, and depressions in which water lodges, should be filled up. The grounds around the house should be levelled and drained so that there are no pools and puddles. The surface drainage of the house should be kept in good order, regularly flushed down and be kept clean. Well kept lawns around the house are pleasant to the view, and on account of their direct exposure to the sun do not harbour mosquitoes. They are therefore an excellent subsidiary protection to the house. Ditches should be lined with masonry so that the flow of water in them during the rainy season is constant, and arrangements should be made for flushing them thoroughly once a week. Ditches near houses not absolutely required for efficient drainage should be filled up.

By carrying out these measures systematically the breeding-places of mosquitoes around the house and near it will be removed. It is by simliar measures to these that such excellent results have been obtained in Havana in Cuba, and Ismailia in Egypt.

Quinine as a prophylactic during the malarial season.

In malarious districts there is generally a season when malaria is particularly rife, and which is called the malarial season. It corresponds, as a rule, with the rainy season, more especially at its commencement and at its end. These are the times when the rain-water which has lodged in hollows in the ground and formed pools and puddles everywhere, lies there undisturbed, and in its stagnancy is favourable to the life of mosquito larvæ. During the heavier rains the pools and puddles are usually too often scoured out or disturbed to form favourable breeding places.

It is often advisable at the commencement of the rainy season and again at its termination, when everything is drying up, to take 5 grains of quinine daily as a prophylactic, or better still, 15 grains on two successive days every ten days; for instance, on the 10th and 11th of the month, again on the 20th and 21st, and again on the 30th and 31st. Euquinine being tasteless, though slightly more expensive, is far better for routine use as a prophylactic. Persons who have once had malarial fever should use quinine systematically as a prophylactic for at least two years, continuing its use at home. Quinine will greatly assist the protective measures recommended, but it will not provide protection without those measures. Care also must be taken to avoid chills as much as possible, in order to prevent relapses of malarial fever.

Sale of quinine at every post office.

The Indian Government has facilitated the purchase of quinine by selling it at cost price at every post office in India; thus the villagers of malarious districts have no difficulty in obtaining quinine. It is a procedure that might be adopted with advantage by other Governments having malarious possessions.

YELLOW FEVER AND FILARIASIS.

The discovery of the *rôle* of the Anopheles in the production of malarial fever has led to the further discovery that other mosquitoes of the Culex variety spread two such formidable diseases as yellow fever and filariasis.

The larvæ of the Culex, it will be remembered, have their breathing tubes opening in a prolongation from the tail (see fig. 4, p. 53). It is because of this that when they come to the surface of the water they remain suspended from the surface by their tails, their heads hanging down in the water. It is by this attitude that they can be easily recognised in contradistinction to the Anopheles, which lies horizontally with the surface of the water.

Yellow fever.

Yellow fever has its principal home in the ports on the Gulf of Mexico and the islands close by. It is seen in the West Indies and occasionally on the West Coast of Africa. Cuba until recently was one of its chief endemic centres. Early in 1901, Read and certain other American physicians proved by their researches that yellow fever was spread by the bite of the mosquito known as the Stegomyia. Being a practical people, the Americans soon put into practice the information derived from this discovery. General Wood, the Governor of Cuba, who was himself a medical man, took immediate steps with his sanitary officer, Dr. Gorgas, to prevent yellow fever in Cuba. Measures were introduced to destroy the larvæ of mosquitoes in the town, to destroy the adult mosquito in the houses, and to screen all the sick from mosquito bites. The result was remarkable. There was an immediate drop in the yellow fever mortality. For the ten years previous to 1901 the average mortality was 467. For the year after the operations against the mosquito was begun, the mortality from yellow fever was only five. The preventive measures have been regularly continued and used, and now for the first time in 150 years, Cuba is free of yellow fever and continues to be free.

An additional interest attaches to this very successful campaign against yellow fever, and it is that the clearing of the town of Havana of mosquitoes generally has also resulted in a remarkable reduction of the mortality from malarial fever.

It may be mentioned here that it is only during the first three days of the illness from yellow fever that the patient can infect the mosquito, and that the infected insect cannot communicate the disease until after the lapse of twelve days.

Filariasis.

Filariasis is the term applied to the presence of a worm-like parasite, known as filaria, in the blood of persons who have become infected. The filariæ live in the blood, sometimes causing no inconvenience, but in other cases they are the cause of serious diseases, one of which is elephantiasis.

It is now many years ago since Sir Patrick Manson, working in China, made the discovery that the filaria is extracted from the blood of a filarial patient by the mosquito, and that in the body of the mosquito the parasite undergoes another cycle of life. It remained for Dr. Low, of the London Tropical School, one of Sir Patrick Manson's pupils, to demonstrate that the young embryos get into the proboscis of the mosquito, and in this way, when the mosquito can be injected into a healthy person, thus infecting him. The mosquito infected with filaria spreads filariasis in a similar way to that in which the mosquito infected with the malarial parasite spreads malaria.

Measures against mosquitoes will prevent malaria, yellow fever, and filariasis.

It will be clear, therefore, that the protection from mosquito bites has an all-important bearing on the prevention of malaria, yellow fever, and filariasis. In any district in which any of these diseases prevail, it is only courting an attack if mosquito-nets are not used for the bedroom, and mosquito wire protection for the house, in addition to

Individual effort necessary.

the regular destruction of larvæ in the immediate vicinity of the house. This is the duty of the individual to himself. Further measures, however, require to be taken by the local authority. A man may take the necessary precaution so far as lies in his power to protect himself, but a careless neighbour may materially assist in neutralising the beneficial effects of the precautions by having large breeding-places for mosquitoes next door. It is here that the co-ordinating powers of the local authority is required. The local authority should insist that certain precautions should be taken by each householder to prevent breeding-grounds of mosquitoes being formed or retained. It should regularly inspect the premises and surroundings of the poorer classes, where puddles are very likely to be found. It should maintain a mosquito brigade such as advocated by Major Ross to drain marshy ground, remove puddles, rubbish and rank vegetation, and it should employ an efficient sanitary service.

Measures by the Local Authority also necessary.

ENTERIC OR TYPHOID FEVER.

Enteric fever is, next to malarial fever, one of the most common infectious fevers among Europeans in India, though it is by no means so common in many other parts of the tropics. It attacks the young rather than the old, the most susceptible age being from 16 to 24. In the English Army in India it is always a disease which the young soldiers run a considerable risk of contracting.

Period of incubation and course of the disease.

The period of incubation, or period that elapses between the time when the infectious material has been taken into the body and the time when the patient begins to be ill, varies generally from seven to fourteen days, occasionally it may be a little longer. During this time there may be a feeling of tiredness and disinclination or inability to work. The disease commences in different ways, sometimes with shivering, at other times with diarrhœa and pain in the abdomen, and at other times with bleeding at the nose. Accompanying this is weakness and fever, which generally forces the patient to take to bed. Along with the fever, which is higher in the evening and soon reaches 103° or 104°, there is headache and maybe wandering at night. The tongue is coated and white; the bowels may be loose or constipated, and towards the end of the first week there may be rose-coloured spots on the body, especially on the abdomen. In the second week the fever continues high, there is a good deal of mental confusion and the patient is dull; the diarrhœa, if present, increases; the abdomen becomes swollen and tender; the pulse rapid, and the patient weaker and duller. In the third week the fever begins to fall, and in some cases, beyond great weakness and emaciation, no very pronounced symptoms occur; but in others, the diarrhœa, tenderness and distension of the abdomen become worse, delirium occurs, cough from lung trouble sets in, and there is special danger of the patient dying from failure of the heart's action or from perforation of the bowels, owing to the ulcers in the intestines, which are one of the important features of the disease.

In the fourth week convalescence, as a rule, sets in, the temperature falls to normal or even below, the tongue cleans, the intellect becomes clear, the diarrhœa stops, and the appetite returns. In other cases, however, the patient's condition becomes worse, there is increasing weakness, the expression becomes heavier, the tongue and lips dry and covered with dark-coloured matter, and the patient falls into a condition of stupor and low muttering delirium, with loss of control over the excretory functions of the body. This stage is attended with extreme danger to the patient and often ends in death. But even from this stage the patient may recover after a protracted convalescence.

Great care has to be taken during the period of convalescence, whether it be from a mild attack of typhoid fever or a severe attack, that only the lightest and most digestible food is given. The appetite is often ravenous, and many persons have lost their lives after having successfully passed through the disease because of eating unsuitable food, and too great quantities, which have brought on a relapse or caused perforation of the bowel.

Causation.

The disease is caused by a bacillus or germ known as the Enteric or Typhoid fever bacillus. This generally gains an entrance into the body through the alimentary canal, being swallowed in food or drink. It may on occasion, however, enter by means of the lungs. Once swallowed it begins to multiply in the bowel, causing certain ulcerations in the mucous lining, enters the blood-vessels, and is to be found in the blood. Having reproduced itself in enormous numbers, it leaves the body in the discharges from the bowel and in the urine. In those cases in which it attacks the lungs the bacillus is found in the sputum coughed up by the patient; clothes or bedclothes soiled with these discharges, utensils receiving the discharges, the hands of patients unless kept clean, the hands of nurses unless washed and disinfected, and any place where these discharges are thrown or deposited become infected with the living germs of the disease.

Mode of exit of infection from the body.

To prevent spread of the disease therefore from the sick room, to others in the house or

Prevention of the spread of typhoid fever.

to neighbouring houses, all evacuations should be received in utensils containing a disinfectant such as carbolic acid, cyllin, or corrosive sublimate, all soiled linen and other articles of clothing should be placed at once in a solution of one of these disinfectants and should remain in the solution for two hours. This removes stains and disinfects them. But to make the disinfection certain they should afterwards be boiled in water for a quarter of an hour, all cups, spoons, &c., used by the patient should be immediately placed in a solution of carbolic acid or cyllin and afterwards scalded with boiling water, the patient's hands should be washed in water containing cyllin or izal ; after attending the patient the nurse should wash her hands in water containing a similar disinfectant, then in hot water, scrubbing her hands with a nail brush. The motions, urine and sputum after thorough disinfection should be either boiled or buried at a depth of at least two feet in the earth, and before being covered with earth have added to them any of the disinfectants previously mentioned or chloride of lime. The utensil itself should be thoroughly disinfected in addition. This is best effected by boiling it in water containing a disinfectant. Cloths or rags used for cleaning the patient after evacuation of the bowels should be immediately placed in water containing disinfectants and boiled, or should be burnt. By these means, the infectious material is destroyed immediately it leaves the body. If it is not destroyed at once it is liable to contaminate food and drink, multiply in these and then gain an entrance into the body of some healthy person.

Destruction of the infectious material immediately it leaves the body all important.

If by throwing the discharges containing the bacillus on to the ground, the germ of typhoid fever reaches the well of the house, or a neighbour's well, or the public well, the people who drink that water will become affected by typhoid fever ; or if the discharges are thrown on to the ground the infection may be taken into the house on boots or on utensils which have been placed on the ground. All insanitary conditions favour the spread of typhoid fever, especially an improper disposal or absence of disposal of excrement and urine. And it is because of the great defects in the disposal of sewage and the many contaminated wells in the Tropics that typhoid is so prevalent.

The dissemination of typhoid fever occurs accordingly through contamination of the soil, water, or food by means of the typhoid bacillus, and as the bacillus is in the motions, urine and sputum of typhoid patients there is the risk of the spread of the disease whenever these are not thoroughly disinfected. Thus it happens that at one time it is an infected soil which produces the disease, at another time infected water, at another infected milk, at another infected salads taken from gardens fertilised with human manure, and at another time infected oysters which have been grown in sewage-contaminated water.

Precautions against typhoid fever.

All drinking water and milk should be boiled. The typhoid bacillus is unable to withstand thorough boiling even for five minutes, and if this precaution is taken with these important articles, quite three-quarters of the risk of contracting typhoid fever in the Tropics disappears. Salads and uncooked vegetables ought not to be eaten in the Tropics unless they have been carefully washed with boiled water and the whole process has been supervised personally. Servants cannot be depended on to take the requisite precautions. Oysters should also not be eaten unless some guarantee is given that they are not reared in water which is liable to sewage pollution even in the slightest degree. It is safer, however, to deny to oneself the pleasure of the partaking of oysters.

The utmost cleanliness should be insisted on in all latrines connected with the house and its premises, disinfectants being freely used in the utensils. If the contents of the latrines are taken away by the local authorities in pails or carts, the pails or carts should always be thoroughly cleansed and disinfected by the local authorities before being brought back to the house premises. Any neglect of this very necessary measure should be immediately reported and action insisted on at once.

CHOLERA.

Causation.

CHOLERA is caused by a microbe, curved like a comma. When this comma bacillus is swallowed in considerable quantities in infected water or food it multiplies in the bowels, and in the process of multiplication produces a poison. This poison becomes absorbed in the system and gives rise to vomiting, violent purging and collapse, which ends in death in a few hours. The microbe can grow under favourable conditions outside the body as well as in the bowels of man. It grows in the soil of certain tropical regions in which the disease is endemic, such as the delta of the Ganges. It can be conveyed elsewhere beyond these endemic regions by the agency of infected articles or persons. If it finds suitable conditions of temperature, of soil and water in the new locality into which it has been carried, the microbe multiplies and converts this new locality for the time being into an epidemic area.

Symptoms.

A cholera patient not dangerous to others if certain precautions taken.

A cholera patient is not dangerous to others if care is taken to disinfect and destroy the bowel discharge and soiled linen; but should this precaution be neglected and the microbes gain access to food or drinking-water, then the patient becomes a source of danger not only to the household but also to the neighbourhood. Whoever eats the contaminated food or drinks the contaminated water is likely to be attacked by the disease.

Immediate treatment necessary.

An attack of cholera may be preceded by diarrhœa for a few days, or it may occur suddenly, especially in the early hours of the morning. Unless immediate treatment is adopted, and not infrequently in spite of treatment, the patient rapidly becomes collapsed and dies in a few hours. No diarrhœa, however slight in its nature, should be neglected in a cholera country or at the time of cholera epidemics. Medical assistance should be sought for at once in order that the diarrhœa, if possible, should be checked. In the case of cholera medical assistance should be sent for immediately. Every moment is of importance, and in the meantime until the doctor arrives an anti-cholera pill should be taken, or a dose of chlorodyne or ten drops of laudanum and the same number of drops of dilute sulphuric acid in a little water. If these are not in the house, a wineglassful of vinegar and water taken in sips at short intervals may prove useful. Keep the patient in bed and warm, apply a mustard plaster to the abdomen, and give small pieces of ice to relieve thirst.

To prevent spread of the disease.

To prevent any contamination of food and water, the discharges should be received in a vessel and then covered with carbolic acid or other disinfectant, and if possible boiled. If they cannot be boiled they should after disinfection be buried deep in the ground, far away from any well; they ought on no account to be thrown into the latrine, or on the surface of the ground. Soiled linen and clothing, utensils, spoons, &c., used by the patient or nurse, or which have been in the sick room, should be boiled. Those articles of clothing that cannot be boiled should be burnt. The hands of the nurse and patient should be washed in water to which carbolic acid or other disinfectant has been added.

Precautions.

The precautions against cholera resolve themselves into drinking no water or milk unless it has been thoroughly boiled, eating no food or vegetables unless fresh and properly cooked, and being careful as to the sanitary arrangements of the house. To prevent its spread, when it does occur in a house, a careful destruction of the infective matter must be carried out, in addition to the other precautions recommended. In the event of being obliged to go into a cholera district during an epidemic, it is advisable to be inoculated against cholera. The operation is simple, and consists in the injection under the skin of a specially prepared prophylactic. The vaccine causes a slight indisposition, with fever and headache and pain at the seat of the inoculation for twenty-four hours, but the pain is not greater than that caused by an ordinary vaccination against small-pox. The protective effect of the cholera inoculation is secured in from four to seven days and continues for at least six months, and usually much longer.

DYSENTERY.

Causation.

Dysentery is essentially an inflammation of the inner lining of the large bowel, and is caused, it is believed, at all events in its most aggravated forms, by a specific microbe. Anything that disturbs the nutrition and circulation of the blood in the bowels is apt to predispose to dysentery. Thus a chill brought on by inattention to the ordinary rules of living, or by exposure to the vicissitudes of the weather, the eating of coarse and indigestible food, a defective diet, drinking of polluted water or water with much suspended mineral matter in it, and dwelling on an excreta-polluted soil, are all probably exciting causes. It is not infrequently associated with other diseases, such as malarial fever and derangements of the liver. Sometimes it assumes an epidemic form, due to the pollution of drinking water by the specific germ, while at other times it is due to the germ being communicated from one person to another by insanitary latrines, and in other ways.

Dysentery may be mild or severe. In its severe form serious lesions in the bowels are produced, which, when the disease is recovered from, may interfere with comfort and health, and render the sufferer more or less an invalid for life.

Symptoms of disease.

The disease may come on suddenly, but is usually preceded by ordinary diarrhœa, to which are soon added griping and straining. The desire to go to stool becomes incessant, little is passed other than slime or serum mixed or streaked with blood. The straining and griping are most distressing, and the small quantity of blood and mucus passed gives no relief.

Treatment.

Dysentery is a disease which should be attended to at once, and its course cut short as soon as possible. There should be no delay in sending for the doctor. Until the doctor arrives, an enema of warm water, plain or with a tablespoonful of boracic acid added, may be used to wash out the bowel; the patient should go to bed, a mustard plaster or fomentation should be applied to the abdomen, and only liquid food taken.

For mild cases of dysentery one or two teaspoonfuls of castor oil with twenty drops of laudanum, or a similar dose of castor oil emulsion may be given night and morning with good results; but for the severer forms in which there is no solid matter but only blood and mucus in the evacuations, then either ipecacuanha or magnesium or sodium sulphate must be given. If no doctor is at hand, 10 drops of laudanum may be taken, followed in half an hour by 20 grains of ipecacuanha in capsules or pills. These should be taken on an empty stomach, and the patient should remain in bed as quiet as possible in order the better to resist any tendency to sickness which the drug is apt to produce. In those cases, however, in which vomiting occurs, it is better to substitute sulphate of magnesia or sulphate of soda A teaspoonful of Epsom salts dissolved in an ounce of water, to which five drops of dilute sulphuric acid and a little cinnamon water have been added, given four or five times a day and continued for one or two days until the blood and mucus have disappeared from the stools has, as a rule, proved very beneficial. During the illness, and until the motions become solid and natural, the diet should be sparing in quantity and consist mainly of thin soup, barley or rice water, boiled milk and sago.

Prevention.

The most important consideration, however, is prevention of the disease, and for that purpose the same precautions are to be taken as set down against malarial fever, chill and cholera. Fevers and chills must be avoided, for they are important factors in the causation of dysentery owing to the engorgement of the internal organs which they induce. Special attention must be paid to securing digestible and suitable food and warm clothing, while every care should be taken to protect the system against the weather, especially cold and damp, and the more so if fatigued or in a low condition of health. Habitual constipation and an excessive amount of alcohol and meat should be avoided. All motions from a patient suffering from dysentery should be thoroughly disinfected before being disposed of. The best disposal is boiling.

PLAGUE.

Ten years ago plague was looked upon only with an historical interest. The disease, which had created so much terror and committed so many ravages in the fourteenth, fifteenth, sixteenth and seventeenth century, was considered to be as extinct as the dodo. To-day plague is no longer historical, and in China and India has, during the past eight years, manifested its old powers of destruction. Over a million deaths from plague occurred in India last year.

The disease is caused by a microbe, which has a peculiar liking for the lymph glands of the body, and is generally characterised by high fever, early delirium, and swellings, which are called buboes, in the armpit, neck or groin. In some cases the microbe attacks the lungs and produces pneumonic plague. In pneumonic plague the sputum brought up with the cough is blood-tinged, and swarms with plague bacilli. On account of this it is infectious, and anyone closely associated with a pneumonic case of plague is apt to contract the disease. On the other hand, plague with buboes does not possess that infectious property, and is not dangerous to others in the same way. Unlike pneumonic plague its dissemination is usually effected by clothes infected with the discharges from a plague patient or by rats, which are very susceptible to plague, or by food contaminated with infectious material from an individual attacked with plague, or from a plague stricken rat. Fleas and other insects are also believed to be the means of spreading plague.

Rules to be Adopted with the Object of Protection against Plague in a Plague-stricken District.—The first and foremost rule is to live in a dry clean, well lighted and well ventilated house, free of rats. The next rule is to preserve a good state of health by regular living, and the third is to be inoculated against plague. Plague will not flourish in a sanitary house, and no house can be said to be sanitary if, in addition to good lighting and ventilation, it is not free of rats. If there are any rats, measures should be taken at once to poison them, and to remove any conditions which are liable to harbour them. Good health is maintained by attention to the general hygienic regulations conformed to in ordinary times. Excesses are to be avoided, or anything that is known to lower the state of health.

Inoculations are useful against accidental exposure to infection, either by infected clothes or in houses which may be infected, and which are in an insanitary state. Haffkine's prophylactic produces slight indisposition for two days, and pain at the seat of the inoculation for several days longer, but it secures a strong protective effect for at least six months. Yersin's prophylactic serum produces less local reaction, but its protective effect does not last more than ten days or a fortnight. Nurses who have to attend plague cases should always previously be inoculated; they should also be careful to disinfect their hands, never to eat their meals in the same room, and to regularly enjoy a few hours out of doors every day.

DISEASES OF THE LIVER.

In the Tropics the liver of Europeans is particularly susceptible to disorder. Every meal produces physiologically a certain amount of active congestion of the liver, which is intensified if the diet is rich and excessive in quantity, and alcohol is taken. Formerly, when the conditions of healthy life in the Tropics was less understood, when little was done to mitigate the injurious effects of the heat or to avoid chills, when heavy and frequent meals, consisting of meat and rich curries, were washed down with beer and strong wines, liver diseases were common. A painful and tragic experience has but too well demonstrated the fact that it is necessary for a European, when transferred to a warm climate, to modify his mode of life and adapt it to his new environments; European habits of life must at all events be partially discarded if good health is to be enjoyed in the Tropics, and in proportion to the extent to which this adaptation has been effected tropical liver affection and tropical liver abscess have lessened in frequency. Regular exercise, attention to the bowels, proper protection against the sun, well ventilated rooms which are not draughty, the dispensing with heavy tiffins at midday and the more moderate use of alcohol, have worked a wonderful change in this respect.

It is unnecessary to enter here into the several forms of liver diseases which may be contracted in the Tropics. They may be summed up as mainly the effects of acute and chronic congestion, ending sometimes in abscess. Abscess of the liver may, however, also follow an attack of dysentery, which renders the early treatment of dysentery all the more important.

Acute Congestions are usually brought about by a chill contracted, it may be, by exposure to rain, or to a cold wind or draught, while fatigued or after violent exercise; or to exposure to night air in unsuitable clothing, after the hot and impure air of a public assembly or dance, or to a cold bath when exhausted, or to any cause which suddenly checks the perspiration, and drives the blood into the internal organs.

Pain and uneasiness on the right side, discomfort in breathing on lying on the left side, yellowness of the eyes, sleepiness and slight fever are the more prominent symptoms.

If medical advice is not within reach, palliative measures may be taken until the doctor arrives. These consist in taking a warm bath, going to bed, and placing over the right side, where the pain is felt, a mustard plaster, or a poultice with mustard, or a flannel put into hot water, wrung out, and sprinkled with turpentine. An aperient pill, followed in the morning with a dose of Hunyadi water or Apenta water, or, failing these, Carlsbad or Epsom salts should also be taken. At the same time the diet should be restricted to milk and light puddings.

Chronic Congestions are more frequently due to long continued residence in the Tropics, and exposure to constant high temperature, together with a too stimulating diet, a sedentary habit of life, and sometimes repeated attacks of malaria. The best remedy is a change to a more temperate climate, or a sea voyage. Great benefit is usually obtained by a careful course of mineral waters and baths under medical advice at one or other of the health resorts in Europe. Of those in Britain, Bath, Harrogate, Strathpeffer are probably the most suitable for these kind of cases.

In dealing with sunstroke, cholera, dysentery, and acute congestion of the liver, some simple form of treatment has been added to the measures of prevention. This has been done because the diseases are such that if not attended to at once, they are likely to prove dangerous to the patient. To attempt to treat oneself when ill is highly imprudent, and is seldom successful. There are, however, occasions on which a sudden emergency arises when far away from medical assistance, and when the illness or accident requires prompt treatment. In these cases the resort to some simple remedy until the doctor arrives may be invaluable. Snake bites, insect bites and wounds require remedies to be applied at once, and for this reason they are dealt with here.

CHAPTER V.

SNAKE BITE.

SNAKES are classified as vipers and colubrines.

Vipers.

Of *vipers* there are the rattle snake, the lance snake, the mocassin snake, the puff adder, the Indian viper or Daboia Russellii, and others.

Colubrines.

Of *colubrines* there are the coralline snake, the spectacled snake, or Cobra, with its hood, Cleopatra's snake, the krait or blue adder, the black snake, the tiger snake, the spine tailed death adder and the sea-snakes.

Safest to treat all snakes' bites as poisonous.

All of these are poisonous, but the majority of snakes in a country are, as a rule, not poisonous. It is safer, however, if bitten by a snake to act as if it were poisonous, unless there is certain proof that it is not poisonous.

A venomous snake, with its two poison fangs, leaves a different kind of wound from a harmless snake with numerous teeth. An examination of the wound will often at once decide this question. A poisonous snake will produce two red punctures on the skin about one inch apart, whereas a harmless snake will leave a row or double row of punctures. The punctures can generally be seen by the naked eye, but at times may require a magnifying glass for their recognition. The symptoms of

Symptoms.

snake poisoning are not long in making themselves evident. No time should be lost in applying remedial treatment. The symptoms depend on the size and kind of snake, also the amount of poison injected with the bite, and whether the snake has recently emptied its poison sack by biting something else. Children and people in a bad state of health withstand the effects of the poison less than the strong. The symptoms differ somewhat in the cobra and the viper. With the viper the local pain is severe, the general symptoms are longer in appearing, and there is likely to be subsequent blood poisoning, from which it takes a long time to recover. With the cobra the local symptoms are not nearly so severe, but the general symptoms come on quickly, and if recovery takes place there are no serious after-effects.

The chief symptoms following the bite of a poisonous snake are pain and swelling at the seat of the wound, gradually spreading up the limb, faintness, sickness, vomiting, inability to stand, difficulty of breathing, gradually slowing down to suffocation, coldness of the body, feeble pulse, and death occurs either by suffocation, convulsions or paralysis of the heart.

Treatment.

Unfortunately no absolute antidote against snake bite is known. Calmette's "Antivenine" is the nearest approach to an antidote, but, as its efficacy depends largely on its being injected direct into the veins, it is a form of treatment that can be employed by a medical man only.

Medical assistance should be sent for immediately, but local treatment should be begun at once. A snake bite admits of no delay in its treatment. Promptness gives the individual a good chance of recovery. To wait to see if any illness ensues means most likely the death warrant of the patient.

The great object to attain is to prevent the poison getting into the general circulation of the blood. With that view, as the bites are generally on the hands, or feet, or legs, or arms, a stout cord should be tightly twisted round the fingers, toes, or limb, a few inches *above* the wound. That is, the cord has to be tied round the part, so as to be between the bite and the heart, *i.e.*, to intercept the circulation. A second ligature or cord should be bound round the limb a little higher up. Time should not be wasted looking for cord. If none is at hand a twisted handkerchief, bandage, piece of cloth torn from a garment or sheet may be bound round the limb. The necessary tightness should then be secured by placing a stick underneath the article used as a ligature, so that it will be between the ligature and limb, and then twisting the stick.

Having applied the ligature, the snake bite wound should be freely cut open with a clean knife, and caustic or acid applied to it. If Condy's fluid or crystals of permanganate of potash are at hand they should be used for cleaning the wound. In fact, so valuable are crystals of permanganate of potash for snake bites that no one who has to travel much where poisonous snakes are numerous should be without a supply. Hunters, if bitten by a venomous snake, will, after the application of the ligature and cutting open the wound, pour some gunpowder into the wound, and then light the gunpowder with a match. This will cauterise the wound, the object of which is to destroy the poison. If there is no chemical at hand to apply to the wound to destroy the poison, the snake bite, after being cut open, should be thoroughly sucked. In doing this, care should be taken to spit out immediately the blood and poison thus taken into the mouth, and also to rinse the mouth. Snake poison, taken by the mouth, usually produces no ill effects, but there is always risk if there happen to be any abrasions in the mouth. After treatment of the wound, the higher ligature may be removed, otherwise, if kept on too long, the limb, not receiving blood, may die.

Precautions to be taken against snakes.

In travelling where snakes are numerous always wear strong boots and good puttees or leggings, never be without a good strong stick, and observe where you are going. The hæmadryad—which is called the man cobra, and may grow to about fourteen feet long—and the zambra are about the only snakes actually dangerous when met with. These inhabit damp and jungly places, and if disturbed may attack man. Other snakes will seldom bite unless accidentally trodden on, or in such a position that they cannot get away. Bath-rooms should always be well lighted, and should have nothing in them under which a snake can conceal itself. Old buildings in a state of dilapidation should be avoided.

Treatment of stings and bites of insects.

The stings and bites of insects—whether they be those of the scorpion, the bee, the wasp, the spider, the centipede, or other insect—seldom produce more than local irritation, pain, and swelling. Sometimes, however, by reason of the number of wounds they inflict, they may cause serious symptoms, or even death. Fatal results have sometimes followed from wounds inflicted by a swarm of bees or wasps. For relief of pain the wound, if possible, should be sucked. A good application is a paste prepared with ipecacuanha powder and water, and smeared over the wound or wounds. If this is not at hand, some spirits of wine, vinegar, eau de Cologne, alum, tobacco juice, or ammonia should be applied. The sting of a wasp may be removed by pressing the opening with a watch-key over the part, first of all being careful to locate the exact position of the sting. Irritation of the skin and painful swellings caused by ants, spiders, beetles, sand-flies, or mosquitoes may be treated with ammonia, vinegar, ipecacuanha, kerosene, or any of the essential oils, such as eucalyptus, cinnamon, &c.

The Sand flea.

The sand flea, commonly called the Chigger, is apt to cause intense local irritation, inflammation and a painful sore. This is due to the pregnant female chigger burrowing into the skin and swelling up to the size of a pea, because of the numerous eggs she contains. If the skin is unbroken the black speck indicating the opening at which the chigger entered the skin should be enlarged by a needle, and the swollen chigger carefully extracted without breaking it. If not recognised until a sore is formed, a strong solution of carbolic acid should be applied locally.

Protection from sand fleas is afforded by wearing strong boots when out on sand, or in huts, or other places in which they are likely to be present, and never to go about barefooted, even when in one's own house. Insect powder inside the boots, or oil of cloves on the feet, is an additional protection where these insects abound.

CHAPTER VI.

WOUNDS.

Difference between bleeding from arteries and from veins.

THE frontispiece shows roughly the position of the arteries and veins which are close to one another on both sides of the body. In the case of a serious wound of the arm or leg, one or other or both of these vessels may be cut, and very alarming bleeding ensue. It is essential that this bleeding should be arrested until medical assistance is obtained. The method of stopping bleeding from an artery is different from that necessary for a vein, so it is important to be able to distinguish between bleeding from an artery and bleeding from a vein. Blood spurting out in jets, with force, and bright red in colour, is from an artery. On the other hand, blood welling out from the wound in a continuous stream and of a dark colour is from a vein. The course of the blood stream is also different in arteries and veins. In arteries it is from the heart towards the fingers and toes, whereas in the veins it is from the fingers and toes towards the heart. This difference is important to remember when endeavouring to arrest bleeding from an artery. The arterial blood is pumped from the heart towards the fingers and toes, and if the artery is cut it is obvious that to stop any bleeding from the cut the pressure on the artery must be made *above the cut*, or between the heart and the cut and *vice versâ*, if a vein is cut the pressure must be *below the cut.*

Where to apply pressure to arrest bleeding.

The rule, therefore, is that if the blood is red and comes out in jerks or spurts *apply pressure above the cut.* If the blood is dark and comes out in great volume *apply pressure below the cut.* If there is both spouting and oozing *apply pressure both above and below the cut.*

Pressure of the artery or vein against the bone or bones behind it may be carried out

How to apply pressure to arrest bleeding.

by compression with the finger or thumb, or with a pad above or below the wound according to whether the bleeding is arterial or venous, and by a handkerchief twisted tightly round the limb. The handkerchief or other kind of available bandage can be tightened, if found necessary, by placing a stick underneath it and twisting the stick. Care has, however, to be taken that the extra strong pressure shall not be continued longer than necessary, otherwise the limb, not being supplied with blood, may become gangrenous.

Often a simple pad over the wound and a bandage will be sufficient to stop the bleeding, particularly if it is from a vein.

Treatment of wounds.

For a small cut or irregular wound in which no large vessel is injured, the wound should be washed with water in which a tabloid of carbolic acid or other disinfectant is dissolved, covered with boracic lint or ordinary lint dipped in a solution of boracic acid. If the lips of the wound are gaping, they should be brought together by the application of thin layers of plaster and then covered.

Wounds caused by bites of wild animals or of dogs which are suspected of being mad, should be immediately cauterised with lunar caustic, or syringed with a strong solution of Condy's fluid or permanganate of potash. The same should be done to the wound caused by a poisoned arrow after cutting out the arrow.

Burns and Scalds.

Burns and scalds are best treated by the application of a mixture of olive oil and lime water. If olive oil is not at hand, linseed or castor oil may be used. If there is no lime water the oil will do alone. Soak some lint in the mixture or oil and apply the smooth side of the lint to the scald or burn, and then cover with cotton wool to protect the injured part from the air. If oil is not available spread some vaseline or boracic acid ointment on the smooth side of the lint and apply, not forgetting to afterwards cover with cotton wool. If blisters form, prick them with a clean needle and let out the fluid, but do not remove the skin.

Rest the injured part, and keep it cool by applying a handkerchief or cloth, dipped in

Sprains.

vinegar or whisky and water. When the swelling has gone down rub with a liniment, and bandage.

MEDICAL EQUIPMENT.

A case of medicines in a portable form, such as is made up by Messrs. Burroughs, Wellcome and Co., of London, and by other large manufacturing firms of chemists, will always be found useful for those going to the Tropics, where, not infrequently, they may be stationed in a district some considerable distance from a medical man. The drugs taken are better to be packed in the solid form, when possible, as they keep better and are less liable to be lost in the event of bottles breaking. Tabloids as a rule are the most convenient, but tabloids of quinine, though useful for prophylactic purposes, are not so suitable for treatment of an attack of fever, as then the digestive system is often out of order, and the powder is more effective. The powder can be taken in milk. The tabloids are apt to become insoluble on keeping. A bottle of quinine, or euquinine powder for illnesses is therefore preferable. If quinine tabloids alone are taken they should always be broken up before use when taken on account of an attack of fever. A list of drugs and other appliances is appended. The drugs, with few exceptions, can be obtained in the form of tabloids, palatinoids, or pills. The dose will always be on the bottle. Children should never be given opium in any form without medical advice.

DRUGS.

Aloin Compound Tabloids.
Anti-cholera Pills or Palatinoids (Indian Government formula), with instructions how to use them.
Bismuth and Soda Tabloids.
Blue Pill, Colocynth, and Hyoscyamus
Caffeine Tabloids.
Calomel Tabloids.
Cascara Tablets, 2 grs.
Chlorate of Potash Tabloids.
Chlorodyne, 1 bottle.
Compound Rhubarb Tabloids.
Dover's Powder Tabloids.
Effervescing Ammonium Carbonate.
  A. Acid Tabloids. Citric Acid.
  B. Alkaline Tabloids. Ammonium Carbonate Compound.
Epsom Salts.
Hazeline Cream.
Iodoform.
Ipecacuânha in powder, 1 bottle, and in Tabloids.

Phenacetin Tabloids.
Quinine Hydrochlorate, or Euquinine, 1 bottle or in Tabloids, with directions to crush before using.
Soda and Mint Tabloids.
Tinct. Camph. Co., in 15 min. Tabloids (Paregoric) contains Opium.
Tinct. Opii, 5 min. Tabloids (Laudanum).
Tonic Compound Tabloids.
Vaseline.

INSTRUMENTS.

Lancet.
Needles.
Scissors.
Clinical Thermometer.
Small Syringe, Glass.
Higginson's Enema Syringe.
Measuring Glasses in Case, a Minim Glass, and a 2 oz. Glass

BANDAGES &c.

Bandages, 2½ inches wide.
Lint.
Plaster.
Silk.
Safety Pins to fasten Bandages.
Cotton-wool.

DISINFECTANTS

One bottle of Cyllin; 1 teaspoonful to a pint of water is an active disinfectant.
Carbolic Acid Tabloids (one in two pints of water).
Boracic Acid Tabloids.
Permanganate of Potash Tabloids and Crystals.

Instructions are given in the case for the use of the Drugs.

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